PUBLIC WORKS

Devoted to the interests of the engineers and technical officials of the cities, counties and states

DECEMBER, 1937

A. PRESCOTT FOLWELL, Editor

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TIMEWASTERS

Here's to You!

A Merry Christmas and a Happy New Year to all. And may the year 1938 bring you most of the nice things you want.

The influx of work mentioned last month has been intensified. Our apologies for the perhaps mediocre problems of last month; and maybe in the next couple of months we'll be back in shape.

Our problems this month have to do largely with spherical trigonometry. This is a subject that we have neglected since way back in college days when we elected it on the mistaken supposition that it was a "cinch."

The Airplanes A and B:

Two airplanes, A and B, start from the same point on the 40th parallel, north of the equator, at the time of the autumnal equinox. A flies due north at the rate of 120 miles per hour and B flies due west at the rate of 80 miles per hour. After A had flown north for exactly 10 hours, he turns in a southwesterly direction and continues to fly at 120 miles per hour until he intercepts B, who continued to fly west at 80 miles per hour. Just at the time A intercepts B, he is headed exactly toward the afternoon sun. How many hours did each fly; what time was it by the sun at the point of interception; and what time was it by the sun at the point of starting? Contributed by *H. A. Blunk.*

An Uphill Job:

One of our large rivers, the Mississippi, flows for at least a part of its distance up hill. Prove this mathematically. From *Johnson's National Well Driller.*

Remarks on Solutions:

We have been out of the office a lot and haven't had the time to examine our Timewaster correspondence in detail; both of the problems in the November issue were complicated ones, and we felt a little guilty in giving such heavy diet. The answer to the ladder problem is approximately 12.25 ft. We will withhold any comments on the flagpole problem in view of the difference of opinion on the previous problem of this type.

And, once more, a Merry Christmas and a Happy New Year to you all. W. A. H.

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Developing a Well By Shooting

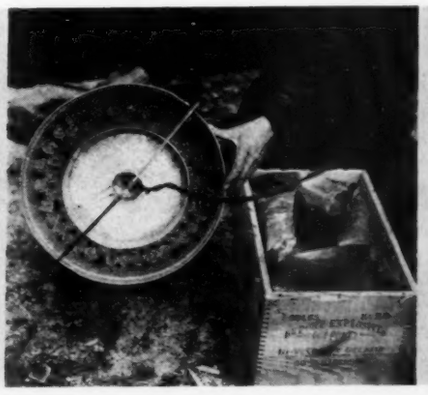
By L. A. SMITH
Superintendent, Water Department, Madison, Wisconsin

ABOUT three years ago the water department of the City of Madison, Wisconsin, completed the construction of a new well, pump house and a small surface reservoir. The well had a 30-inch outer casing to a depth of 100 feet, a 24-inch inner casing to a depth of 200 feet, and a 22-inch hole in the rock giving a total depth of well of approximately 750 feet. The upper 100 feet, between the 24 and 30-inch casings, was grouted. This well was designed to be pumped by air lift from our main station, which is 3,000 feet away, the air being carried to the well through an underground pipe line. When the air lift was installed, the well pumped erratically and produced only about 700 gallons per minute with a drawdown of 100 feet, giving a specific capacity of seven gallons per foot of drawdown.

Inasmuch as additional supply was needed at once, the well was operated this way the first summer, but the cost was too great and the quantity of water insufficient for our needs, so that it was decided to shoot the well, and a bailing outfit was placed on top of the surface reservoir directly over the well. As it is very difficult, before shooting a well, to determine how hard the formations are and what results may be expected, the initial shots were rather small. The first shot consisted of 50 pounds of 40% gelatine loaded in a piece of 8-inch soil pipe. The bomb was lowered into the hole using a ⅛ inch wire, with about 40 feet of ¼ inch rope at the lower end as it was feared that the wire in the vicinity of the shot might ball up and be difficult to remove, a pair of electric wires being run to the surface. This shot resulted in the hole filling up 4 feet with shattered rock. After this had been bailed out, a second shot was fired, using 100 pounds of 40% gelatine, after which the hole filled up 134 feet. The third shot, a week later, consisted of 150 pounds of 40% gelatine, after which 173 cubic feet of material were removed. All of these shots were made with bombs of 8-inch soil pipe.

After the hole had been bailed out it was quite apparent that a more severe shot was necessary and a representative of the DuPont Company was consulted. He suggested that, in place of using a bomb only 8-inches in diameter, one be made very nearly the size of the hole—the purpose of this being to eliminate, as far as possible, the water cushion between the bomb and the sides of the hole. The fourth shot, therefore, consisted of 100 pounds of 80% high-velocity gelatine, the container being 18 inches in diameter. The hole filled up 29 feet and quite a large quantity of material was removed because the hole was much larger in diameter due to the previous shots. A fifth shot, using a larger diameter bomb with 150 pounds of high-velocity gelatine resulted in filling the hole 26 feet, the quantity of

Fifty pounds of 80% ready for lowering.



Same, ready for sand and tar in top of center container.

Pipe container for 50 lb. shot in the form of an 8-inch soil pipe.

material removed being about the same. After the hole had been bailed out again, a final shot was made using 150 pounds of 80% high-velocity gelatine and the hole filled up 215 feet and about 30 cubic yards of sand was removed. Including all the shots, the total quantity of sand removed was 55 cubic yards.

The air lift equipment was then installed again and 900 gallons per minute were produced with a drawdown of 45 feet, an increase of specific capacity from 7 to 20 gallons per foot of drawdown, and when pulled down 100 feet, over 2,000 gallons per minute were obtained. The well was finally developed on the basis of 1,800 gallons per minute, as this seemed to be the economical point considering air pressure required and water produced.

In the shooting, the water was very violently disturbed but in no case did any of it spout out of the hole, the water level in the well being approximately 25 feet below the surface. In order not to have a large number of people around when the shooting occurred, no public mention was made of it except that the Police Department and the University officials were notified—the Police Department so that if anybody reported the blast or explosion, they would know the cause and the University so that when people called up saying they felt an earthquake the University would know that it was simply the shooting of this well. Several people at distances over a half of a mile from the location of the well felt the ground tremor although the noise of the shot was so muffled that no one reported hearing it.

In shooting wells there are several factors which must receive consideration. First of all there is the inherent danger of handling high explosives which, of course, makes it essential that a qualified man properly experienced in this work be placed in charge. Second—care must be taken that the well casing is not disturbed, for the hole may be lost if this occurs. For this reason the shots were all fired at depths between 500 and 600 feet below the surface, and in no case less than 300 feet from the bottom of the inside casing. Third—sand rock varies materially in hardness; if it is rather soft in nature it may be that the shot will dislodge such a large quantity of material that the hole can never be bailed out. This was the reason for our using small quantities of low-percentage gelatine at first.

The total cost, including the use of the bailer, the purchase of the gelatine and containers, and all other labor and material was around $3,500. The original well and equipment had cost approximately $15,000; so that the shooting of this well was, unquestionably, economically sound.

Welding an Aid in Dam Construction

At Fort Peck, in northeastern Montana, where the Army engineers are building a 100 million cubic yard earth-fill dam across the Missouri River, welding for maintenance is playing an important role. On this huge but isolated project, far from sources of supplies and repairs, the engineers have had to provide a means of keeping a vast array of heavy equipment in operation despite inevitable breakdowns and wear resulting from handling highly abrasive material. Welding was adopted and no less than 123 men were employed as welders at the peak of construction.

In nearly every case, heretofore, these maintenance problems had been classed among the "impossible jobs." The greatest number of problems arose in the maintenance of dredges with their pumps, cutters, and impellers, and steam shovels, tractors, and similar machinery. That part of the equipment which has been worn away is replaced by an application of a thin surfacing material which imparts to the rebuilt piece a greater wear resistant quality.

For the repair of worn dredge pump casings, the casing is heated to 800°F before the welding torch or arc is applied. The welder then builds up the worn area or repairs the cracks while the pump is hot. The work is severe but the results are excellent. Some of these pump casings have been repaired by the application of weld metal and hard facing as many as seven times without any loss in pumping efficiency as compared with a new pump.

Another place in which welding played a prominent part in the construction of the Fort Peck Dam was in the construction of the core wall of the Dam. About 50,000 feet of welding was done on sheet steel piling ⅜ inch thick.

Frequently the shop is called upon to duplicate an intricate part using only metal available on the scrap pile. Often special equipment required for a particular job must be made by welding. Again the problem may be that of rebuilding some piece of equipment at hand so that it will be suited for work of a different nature. Whichever is the case it will be found that welding has been used extensively throughout the fabricating process.

This is a brief abstract of a paper by T. B. Jefferson, U. S. Engineer Department, before the American Welding Society.

Sewer Gas Precautions in Chicago

In constructing the seventy-two miles of sewer forty feet below the streets of Chicago, every precaution is taken to avoid accidents or asphyxiation by gas. Several times a day a safey engineer tests the gas content at both top and bottom of every foot of length of each section under construction. Should these precautions fail to protect the men from sudden incursions of gas, a group of trained rescue workers is constantly on hand to go to their aid. This work is being completed with a P.W.A. allotment of $58,000,000.

Digestion of Sewage and Sewage-Garbage Mixtures

Experiments Comparing Results From These, With and Without the Addition of Lime Sludge From Water Softening

EXPERIMENTS were begun in the fall of 1936 at the sewage treatment plant of Flint, Mich., and completed July 25th, 1937, to learn the relative results of digesting sewage sludge alone, sewage sludge mixed with softening plant sludge, sewage sludge mixed with garbage, and mixtures of all three, in varying proportions.

Conclusions derived from these experiments, stated briefly, were as follows:

Lime sludge (that from the softening plant) addition to a digester increases the gas production during the initial stage for a period of about three weeks. But as the concentration of the lime sludge in the digester increases, the gas production is slightly lower than that produced in a digester to which no lime is added. The volume of lime sludge that a digester can handle will be dependent to a large degree on the "rate of digestion". If the sludge is digesting actively, there is a definite stratification of organic sludge and lime sludge. In order to aid in bringing about this stratification, it was found necessary to add vertical extensions to the lower stirring paddle and stir the sludge in the digesters which received lime about once every hour. In this way, gas bubbles would form on the organic particles and bring these up to the scum layer, whereas the inert lime sludge particles would settle to the bottom with the digester sludge. It is evident that, in an actively digesting tank, the lime sludge that is added will be separated from the organic sludge and will not be retained in the tank very long but instead it is withdrawn with the digested sludge.

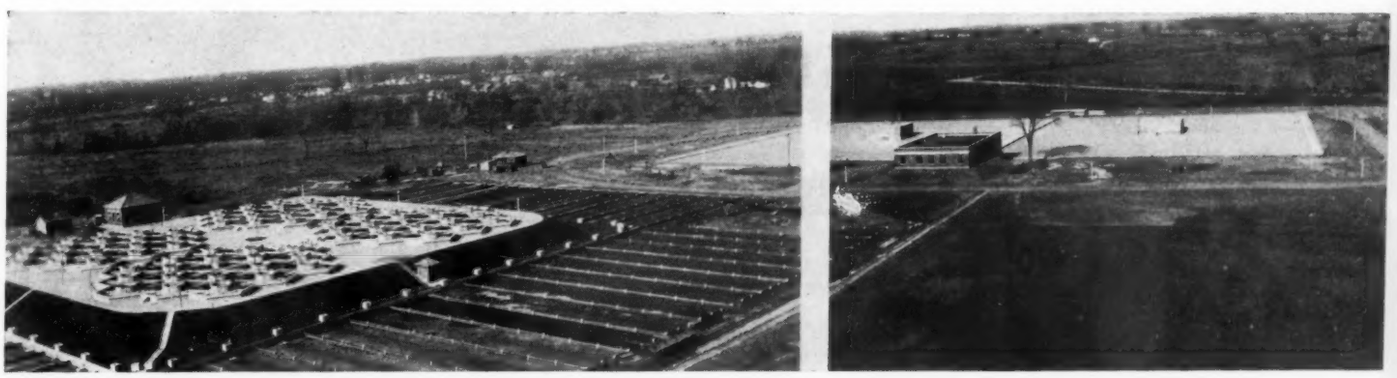
The following conclusions are drawn from the experimental studies on separate sludge digestion:

1. Flint sewage sludge and garbage in proportions actually produced digest readily, producing 11.5 cu. ft. of gas per pound of volatile matter. Garbage averages 91% volatile and the mixture averages 83% volatile matter. The estimated gas production, based on the results obtained from the experimental work, is approximately 445,000 cu. ft. per day.

2. Flint sewage sludge digests readily, producing 10 cu. ft. of gas per pound of volatile matter. Raw sewage sludge averaged 75% volatile. The estimated gas production based on the experimental work is approximately 155,000 cu. ft. per day, including 10,000 cu. ft. per day from the secondary tank sludge. (Estimated population, 156,000.)

3. A mixture of sewage sludge, garbage and lime sludge in proportions estimated to be produced, i.e. one part organic solids to 1.16 parts lime sludge, digests readily without any appreciable decrease in gas production.

4. A mixture of sewage sludge and lime sludge in proportions 1 part sewage sludge to 2 parts lime sludge digests readily, producing a slightly smaller amount of gas than sewage sludge alone but a gas with lower CO_2 content. The studies indicated that a higher ratio of lime could be handled.



Flint sewage treatment plant. Left—Imhoff tanks and drying beds. Right rear—Filter beds, dosing tanks and aeration tank.

5. Proportions as high as 2 parts of lime sludge to one part of a mixture of sewage sludge and garbage digests readily but producing a slightly decreased amount of gas than sewage sludge and garbage alone, but a gas with a lower CO_2 content.

6. With the addition of separate sludge digestion tanks to the present sewage treatment plant, all of the garbage from the City of Flint could be digested, producing a valuable by-product in the gas that can be collected.

The experiments were made with four steel tanks as digesters, each having a capacity of 575 gal. Each had a stirring mechanism consisting of a vertical shaft carrying two 4" x 48" paddles; the two tanks to which lime was added having also six vertical boards fastened to the lower paddle and extending into the conical hopper bottom. Gas was collected in floating conical covers and withdrawn to gas holders of 5.4 cu. ft. capacity.

The sludge used was obtained by suspending 15 gal. tubs in the sedimentation compartment of one of the plant's Imhoff tanks. The garbage was taken from the city's collection wagons, a small amount from each

wagon during a day's run, and ground and water added to make a slurry with a solids content of 10% to 15%. The lime sludge was obtained from the water softening plant of a local factory, and washed about ten times to remove the excess alkalinity found in sludge from small plants.

The treatment plant records showed about 19,400 lb. of solids per day (on a dry basis) deposited in the Imhoff tanks, or 0.124 lb. per capita. Garbage studies had indicated an average of 0.176 lb. per capita on a dry basis. Computation indicated that a softening plant would produce about 0.346 lb. per capita of sludge.

After the tanks had become active, a 6 lb. charge of organic solids was added daily to each tank, 2.5 lbs. of sewage sludge and 3.5 lbs. of garbage to tank No. 1; the same plus various rates of lime sludge to No. 4; 6 lbs. of sewage sludge alone to No. 3, and the same plus various ratios of lime sludge to No. 2.

Half the solids charge was added between 9 and 10 A.M. and the other half 12 hours later; an equivalent volume of either supernatant or digested sludge being withdrawn from the digester before the charge was added. Tanks receiving lime were stirred thoroughly after the charges were added, and once an hour thereafter for seven hours. The temperature of the tank contents was kept at 88° to 94°.

The supernatant 5-day B.O.D. averaged 550 for sewage sludge alone and 1850 for sewage sludge and garbage, and 500 for sludge with lime and 1500 for sludge, garbage and lime.

The experiments were in charge of Pierre R. Welch, chief chemist of the treatment plant, with the help and cooperation of Walter R. Drury (of Shoecraft, Drury and McNamee, engineers), Willem Rudolfs, Prof. H. E. Babbitt, Earl L. Holloway (superintendent of the Flint water supply and sewage treatment plant), John Norgaard, chemist at the treatment plant, and Ira Dowd, senior plant operator.

Winter Care of Acetylene Equipment

The oxy-acetylene process frequently involves the use of equipment in which water is essential to the operation, or in which water may be present due to condensation. Therefore, before and during the season of the year when freezing temperatures prevail, such equipment must be given special consideration and care. This is particularly true where acetylene generators and accessory equipment are concerned.

The importance of preventing acetylene generating and distributing systems from freezing cannot be too strongly emphasized. If freezing does occur, it is of vital importance that the situation be handled quickly and intelligently.

Acetylene when mixed with air in certain proportions is explosive if ignited. In the routine use of most acetylene generators, air-acetylene mixtures are created every time the generator is recharged. These *known* air-acetylene mixtures can be handled with confidence, however, since they are quickly eliminated by following the manufacturer's operating instructions which are furnished with each generator. It is the *accidental* or *undetected* air-acetylene mixtures which are hazardous and which must be prevented.

The freezing of water in acetylene equipment can cause physical damage which may result in the formation of an air-acetylene mixture. Such physical damage may be readily apparent. On the other hand, it may be of such a nature that it is not so easily detected. Even though there is no actual physical damage, freezing may affect a generator and other equipment so that the normal operating routine is unsafe.

Types of Equipment Involved

The freezing of acetylene equipment may be due to two causes: (1) freezing of water used for specific purposes in the equipment, or (2) freezing of water that has condensed out of the acetylene.

The principal types of acetylene equipment subject to freezing are: generators, flood lights, hydraulic back-pressure valves, regulators, relief valves, line shut-off valves, distributing piping and vent pipes, and hose. Of these, only generators, flood lights and hydraulic back-pressure valves regularly use water as a necessary factor in their operation; all, however, are subject to freezing of condensed moisture.

Primary Objectives

The correct winter care of acetylene equipment has three objectives:

(1) To prevent the possibility of freezing in the first place.
(2) If freezing does occur, but has not caused any damage, to thaw out the equipment and put it back into service in the safest possible manner.
(3) If the equipment has been damaged by freezing, to handle the situation in such a manner that the trouble can be corrected and the damage repaired in the quickest and safest possible manner.

There are so many different types and combinations of equipment which may be involved, and so many individual circumstances or local conditions which may arise, that no completely specific set of rules can be evolved to prevent or handle all cases of freezing. Each situation requires individual consideration. There are, however, certain general precautions which may be applied to practically any equipment.

Only One Completely Satisfactory Method

The only completely satisfactory method of protecting acetylene equipment from freezing is to use, store or install the equipment in a room or building in which a temperature of not less than 40 deg. F. is always maintained.

Obviously, however, this will not always be possible, as in the case of a broken down heating system, hydraulic back pressure valves used in a plant which may be temporarily shut down, or, for example, in the case of a portable generator used on a pipeline job. Such cases require special treatment to prevent or handle freezing, and, the natural reaction of a generator user is to inquire, "What should be done in such circumstances?"

If any conditions should arise which make it impossible to protect the equipment by correct housing and heating, or if any conditions arise which leave any doubt as to the safe method of procedure, the wisest course is to communicate with the manufacturer of the equipment, or his representative. The manufacturer will supply special instructions, recommendations and, if necessary, additional assistance.—*Oxy-Acetylene Tips.*

Highway Maintenance Organization in Cincinnati

By J. E. ROOT and CHARLES E. BROKAW
Director, Department of Public Works and Superintendent of Highway Maintenance

IN 1931 there was a rather general reorganization of the Department of Public Works of Cincinnati, Ohio. As a part of this reorganization there were added to the usual work of a highway maintenance organization the operations of street cleaning; sewer repair, maintenance and cleaning; catch basin and street inlet maintenance and cleaning; and the placing and maintenance of traffic signs and street marking to establish traffic lanes, etc. This statement is made to explain briefly some of the things which are peculiar to our highway maintenance organization.

Supervisor.—There are seven supervisors classified and responsible for the functions of the sections of

Macadam Street Maintenance
Hard Paved Street Maintenance
Street Cleaning
Structures Maintenance
Sewer Maintenance and Semi-Construction
Equipment Maintenance
Street Openings, Restoration and Inspection

Each of these supervisors is specialized in one of the above functions. He conducts the activities of his section subject to the approval of the Assistant Superintendent and Superintendent of Highway Maintenance. Since his is an administrative position, he must have the ability to supervise a large group of employees and to deal with personnel problems; to estimate and plan the work of his section according to its importance and in the most efficient manner; he must be thoroughly familiar with maintenance methods and cost data; must be able to coordinate work within his section, and the work of his section with that of other sections in the division. He should have a fair knowledge of the general financing of the entire Highway Maintenance Division.

Foreman.—Fourteen general foremen are responsible to their respective supervisors for the activities in the sub-sections; the number classified in each type of work being as follows:

2—Macadam maintenance; 1—Asphalt maintenance; 1—Block paving maintenance; 1—Concrete maintenance; 1—Sewer semi-construction; 1—Sewer maintenance; 1—Sewer cleaning; 3—Street cleaning; 3—Structures maintenance.

As in the case of supervisors, each general foreman is specialized in one of the above types of work. He plans the activities of his sub-section subject to the approval of the supervisor. He is charged with the activities of at least three crews. He must be thoroughly familiar with maintenance procedure in his own work. He must have the ability to investigate and give a clear report on any complaint or any phase of his particular work. The general foreman in charge of asphalt maintenance must have in addition to the above a thorough knowledge of asphalt plant operation, the ability to order materials in a proper sequence to keep an asphalt plant in operation at all times, and understand the design of asphaltic mixtures.

The Highway Maintenance Division at the present employs twenty-five regularly classified work foremen. The number of these foremen and their classification is as follows: 7—Macadam paving foremen; 3—Asphalt paving foremen; 1—Asphalt plant foreman; 6—General labor foremen; 2—Sewer repair foremen; 3—Yard supply foremen; 1—Garage foreman; 1—Highway equipment foreman; 1—Mechanical repair foreman.

It is unnecessary to go into detail on just what activities these foremen are charged with, except in possibly a few cases; for instance, the general labor foremen classification covers such work as concrete base, mud jack work, construction and maintenance of pre-cast steps, bituminous concrete walks, street and traffic sign erection and maintenance. The highway equipment foreman classification covers the activities and maintenance of all highway maintenance equipment and the construction of special mobile equipment. The mechanical repair foreman classification covers the maintenance of highway maintenance plants, such as asphalt plant and stone crushing plant. These men must have the ability to supervise a small group of workmen. They must know the details of construction and maintenance of their particular type of work. They must be able to report at the end of each day clearly, on the designated form, the work performed by their group, to maintain an accurate record of time for each man in the crew, and to order material in such a manner that the crew is always at work.

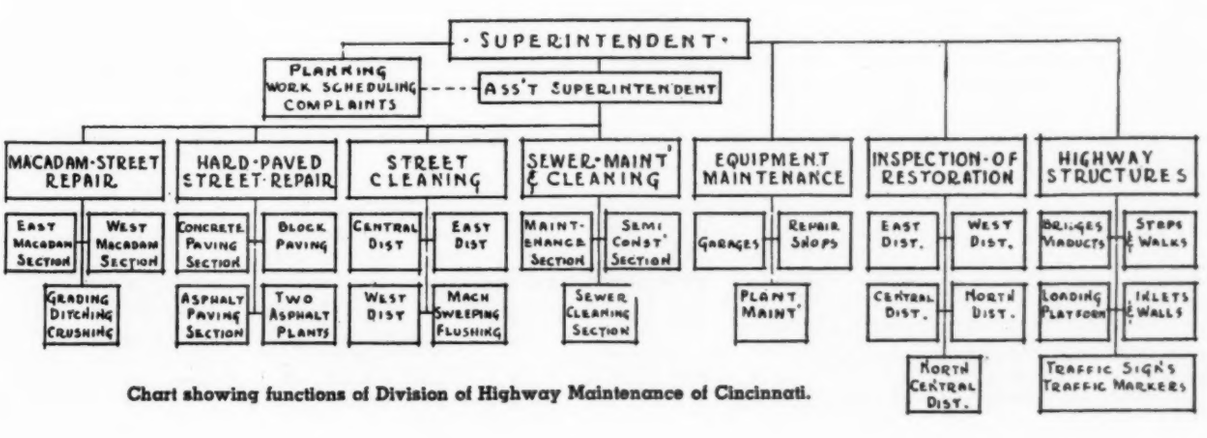


Chart showing functions of Division of Highway Maintenance of Cincinnati.

Plate II—Grade separation structure of composite timber-concrete design, built by Alabama State Highway Dept. 20-foot spans of H-15 design, with concrete rail, curved, skewed and superelevated.

Composite Timber–Concrete Bridges

W. A. STACEY

Engineer, Service Bureau, American Wood-Preservers' Association, Chicago, Ill.

THE present status of composite timber-concrete construction is the outgrowth of nearly 20 years' experience in combining two very different materials to form a homogeneous structural member. The obvious purpose of the combination is to utilize the outstanding properties of each material to best advantage, and eliminate so far as possible those properties of each which constitute liabilities in design, construction and service. Up to the present time composite construction has been limited to beams or slabs. It is equally adapted to other uses, however, and undoubtedly as this construction is developed further it will find advantageous use for other structural members.

In various state highway programs, concrete floors were first placed on creosoted timber stringers in simple span fashion. Then the first step in composite design was made when heavy spikes were driven into the stringer tops, their heads left to protrude 2 or 3 in. into the concrete for the purpose of securing a satisfactory attachment. The results of such spiking were uniformly good, for some degree of true composite action between floor and stringers was obvious, as shown by an increased stiffness of structures under load. Because of the possibilities of the construction, an extensive research project to determine the factors involved in an integral combination of the materials was undertaken by the Oregon State Highway Commission in 1932. Technical Bulletin No. 1 was published by this commission as a result of tests of composite beams, consisting of timber stems and concrete flanges.

Among the advantages cited in this report are: the strength of the composite construction is about twice that of the elements independently used, the stiffness is increased about fourfold, and the concrete surface affords protection from exposure so that virtually permanent life is assured the timber if treated.

The latest development in composite construction has to do with the design of flat slabs applicable to panel or span lengths up to 20 to 24 ft. and in some cases more. This method affords some advantages not possessed by the T-beam type of construction. Fundamentally it consists of a laminated timber base the full width of the slab, with concrete surface forming the upper part of the composite member. The laminations are laid up parallel to the direction of beam action. *No stringers or joists are required.*

In order to develop shearing resistance between the concrete and timber, the laminated timbers are laid with the upper edges of adjacent pieces in different levels, thus forming longitudinal grooves across which in the timbers and also extend up into the concrete. steel plates are inserted so as to obtain a firm bearing Originally, the grooves in the timber surface were formed by using timber strips of different widths, as, for example, 2 x 10 in. and 2 x 8 in., laid alternately in the manner shown in Fig. 1a. The next step in the construction, that of placing the triangular steel plates called "shear developers," is shown in Fig. 1b. The final step, placing of reinforcement and concrete surface, is shown in Fig. 1c. Some 3500 lin. ft. of timber bridges of this type were built across Tampa Bay in Florida in 1933. The project included three bridges, all identical in design, with span lengths of 20 ft.

Somewhat later, similar decks of this kind were built in Alabama, Georgia, Maryland, Delaware, Pennsylvania, and Canada, using 2 x 8-in. pieces throughout. Alternate pieces, however, were elevated 2 in. above the others to form the requisite horizontal grooves. These alternate pieces were held in place by short blocks extending across the supports, which supports in most cases were the caps of timber bents. This arrangement is shown in Figs. 3a and 3b. It provides

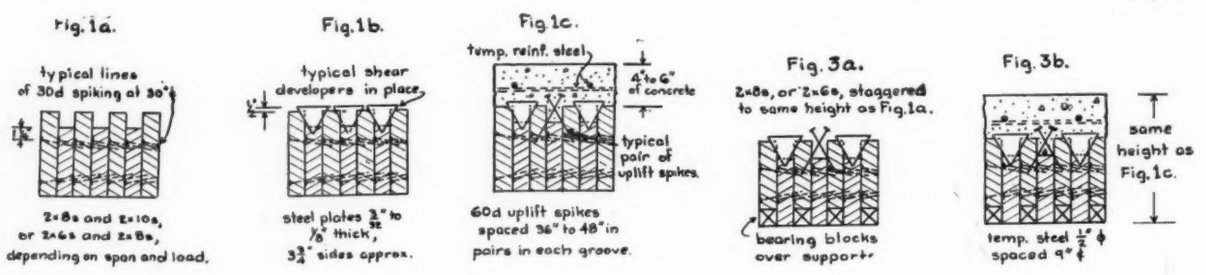


Fig. 1a.
typical lines of 30d spiking at 30°
2×8s and 2×10s, or 2×6s and 2×8s, depending on span and load.
Fig. 1b.
typical shear developers in place
steel plates 3/32" to 1/8" thick, 3 3/4" sides approx.
Fig. 1c.
temp. reinf. steel
4" to 6" of concrete
typical pair of uplift spikes
60d uplift spikes spaced 36" to 48" in pairs in each groove.
Fig. 3a.
2×8s, or 2×6s, staggered to same height as Fig. 1a.
bearing blocks over supports
Fig. 3b.
same height as Fig. 1c.
temp. steel 1/2" ϕ spaced 9"

a slab of the same effective depth, and for practical purposes, the same strength as the original method and effects a saving of 11 per cent in the volume of timber.

Recently, several bridges were constructed in Florida, in which 2 x 8s and 2 x 10s were used, but arranged differently than in the original design using these two sizes. In these bridges the 2 x 8-in. pieces were elevated above the 2 x 10-in. pieces and supported over the caps by 4-in. blocks as shown in Fig. 4a. Thus with the same thickness of concrete the effective depth of the composite slab is increased about 11½ per cent and its strength approximately 27½ per cent. The completed cross-section, Fig. 4b, elevates the concrete flange and provides a stronger beam without the use of more material than that shown in Fig. 1c. The extent to which such arrangements in form can be carried is limited by practical considerations—namely, to retain a groove depth suited to the shear developers and sufficient contact between the strips for effective spiking.

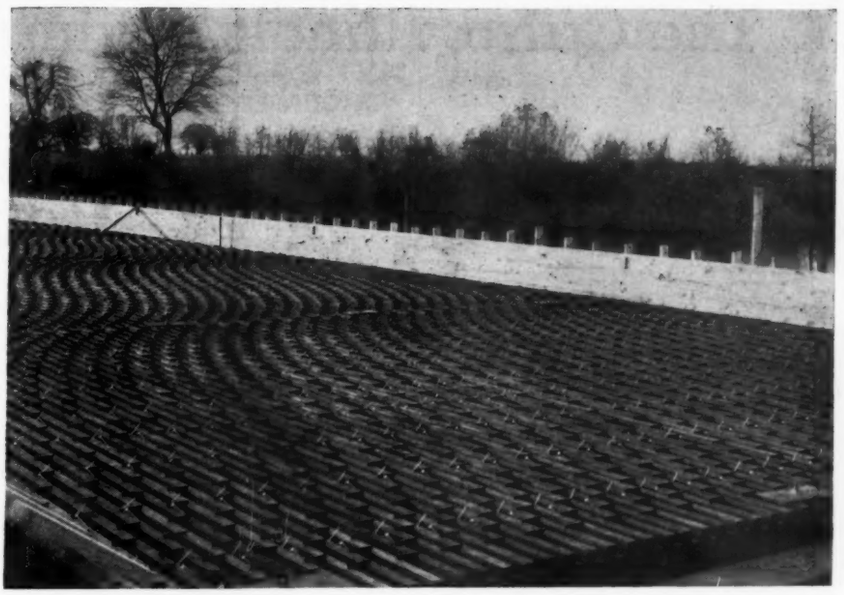


Plate I—Creosoted wood deck with shear developers and uplift spikes in place, ready to receive reinforcing steel and concrete. Mill Creek bridge at Smyrna, Delaware.

In general, in the composite beam, the neutral axis will be nearer the top than the bottom; consequently, the distance from the neutral axis to the extreme fibre will be different for the two sides of the beam. The allowable working stress of the timber is generally double that of the concrette, so it is the latter that usually governs. Since the timbers are permanently held in the design position by the concrete, the shear developers, spikes and other members, their bending under load is determined by the action of the section as a whole, and this obviously is the fundamental factor involved in the composite theory.

When a beam is under the action of transverse loads, and bending takes place, there is, as everyone knows, a tendency for imaginary layers to slip along each other on horizontal planes. In homogeneous beams this tendency is resisted by the strength of the material in "horizontal shear." Since the horizontal shearing forces vary from zero at the extreme fibres of the beam to a maximum at the neutral axis, the strength in shear of a beam must be sufficient to resist the maximum shearing stress, or else failure occurs and the single beam is converted into two independent beams having a greatly reduced bending resistance.

In the composite beams, this is prevented by the shear connections, known as "shear developers," installed in the grooves of the timber lamination prior to placement of the concrete. These are steel plates, ordinarily in the form of equilateral triangles to facilitate placing, and are slightly less than ⅛ in. in thickness. The capacity of the shear developer to transmit stress was determined some years ago. Tests made on so-called "push out" specimens, where the shear members were subjected to direct thrust, gave values which checked very closely those obtained from calculating the shearing forces in the beam tests, and it was found that shear developers of the size and thickness indicated in Fig. 1b developed an ultimate resistance of more than 7,000 lbs. each. From the results of these tests, a working value or design load of 1,750 lbs. each was assigned, and this has been universally adopted.

There is the further consideration involved in the composite beam design of preventing the separation of the two elements. There is never any tendency for the elements to separate vertically under conditions of transverse load. In fact, the opposite is true. Variation in temperature, however, develops a tendency to separation in two distinct forms. The first is the well-known tendency of a thermal-sensitive surface to curl or bend due to differential temperatures in the mass. The second form comes from the disparity in thermal expansion between concrete and timber for the coefficient for concrete is approximately three times that of timber.

This tendency, in both forms, is resisted by the so-called "uplift" spikes, shown in Plate I (also in Figs. 1c, 3b and 4b). These are heavy (usually 60d) spikes driven in pairs at an angle of about 30 degrees to the vertical, located as shown. The pairs, with individual spikes separated 4 in. to 6 in., are usually spaced about 36 in. to 48 in. apart, in each groove, to resist any tendency to separation between the elements, which reflects itself in a *vertical pull* exerted by the concrete. The spikes can not be extracted, and can fail only by tearing through the timber or bending at point of penetration.

As a rule, simple span design and construction is recommended for ordinary purposes. In this, all timber laminations must be of full panel length and the ends thereof supported at the panel points.

Fig. 4a.

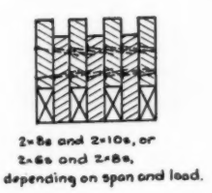


Fig. 4b.

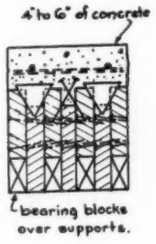
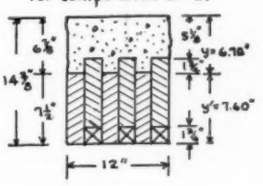


Fig. 5.
For computation of I.



The Cairo, Illinois, Swimming Pool

By CHARLES M. ROOS
Superintendent, Cairo Water Company

Construction of an outdoor pool which has proved its value in preventing drownings as well as affording recreation and as a health builder.

CAIRO, Illinois, celebrated June 3rd, 1937, the opening of its new $50,000 swimming pool, regarded as one of the finest modern out-door public pools in the State of Illinois. The construction of the pool was made possible by using W.P.A. labor, and through the cooperation of the City of Cairo, the W.P.A., the Cairo Rotary Club and the Cairo Water Company. The Rotary Club, which has sponsored swimming as recreation for a number of years, provided for the construction of a pool a number of years ago, which was replaced by the new one recently opened. The old pool made it possible to keep Cairo's children from swimming in the treacherous Ohio and Mississippi rivers which flow past the city. Prior to the construction of the old pool, each year one or more children lost their lives in the rivers. Since the opening of the first pool not a single life of a child has been lost in the rivers. The high diving Olympic championship was won in Paris some years ago by a Cairo girl, Miss Carolyn Smith, who took her first swimming and diving lessons in the old Cairo pool.

The new pool was designed and its construction supervised by the writer. The adults' pool is 100 ft. long, 40 ft. wide, 9 ft. deep at one end and 3½ feet deep at the other. It is lined with white tile, with green "Kraftile" overflow gutters on all four sides. Depth in feet markers at intervals, and distance markers in meters, are on both sides of the pool in black figures and letters burned into white tile.

The children's pool is 40 ft. long, 15 ft. wide and from 18 to 24 inches in depth. It also has white tile lining with green tile overflow gutters. The children's pool is separated from the adults' area by ornamental woven wire guard fencing as a safety provision. The children have a separate toilet and rest room building located in their pool area. Both the children's and the adults' areas have spacious non-slip concrete spaces on all four sides of the pools, with landscaped spaces therein surrounded by guard fences to prevent carrying sand or soil into the pool areas. It was originally planned to provide an under-water lighting system, but this was changed to overhead lighting because of lack of funds.

A separate concrete area, with landscaped and flower bed spaces, has been provided for spectators, separated from the bathers' areas by ornamental woven wire guard fencing, to prevent spectators not in swimming suits from carrying dust and sand to the pools. All areas are well drained by providing drainage at 3 inches per 10 ft. to bell traps connected with the drainage sewers.

Two electric motor-driven centrifugal pumps, one 250 gpm and one 300 gpm, located in the filter room circulate the water at the rate of a complete turnover every 8 hours for each pump. One pump is operated continuously 24 hours of each day. The second pump is operated also during filter washing, which is at the rate of 500 to 600 gallons per minute. The overflow from the gutters of both pools is not recirculated, but is wasted to the sewer. None of the water from the children's pool is recirculated at any time. Water from the adults' pool enters the pump suction lines through two screened openings at the bottom of the deep end of the pool. Water flows into the pools at both ends about 15 inches below the overflow line of the gutters. The gutter brass outlet strainers are spaced 10 feet apart on all sides of both pools.

Three Roberts pressure filters, each 84 inches in diameter, are operated continuously. Two chemical feeders connect to the suction lines of the pumps, between the pumps and the lint strainer or catcher. These chemical feeders are equipped with special "sight feeders" which enable the operator to observe at all times the rate of treatment. One feeder is used for sulphate of alumina coagulent and the other is used for soda ash or other chemicals to control the pH value and alkalinity of the water. A modern well-equipped chemical and bacteriological laboratory is located in the filter room, where daily analyses of the water are carefully made. The room in which are located the filters, pumps and laboratory, is screened off from the spectators' and bathers' entrance in a manner which enables all who enter the pool to see the operation of this equipment. This feature has a good psychological effect, and gives the public confidence in the sanitary quality of the water and in the operation of the pool. The pool water is excellent, with zero turbidity, entire absence of coli-aerogenes, and with unusually low total bacteria counts at all times. At no time since the new pool has been in operation has the quality of the water been below the standard for safe drinking water. Pool patronage has been unusually heavy each day since it has been in operation. Special provision has been made to keep the dressing rooms and all bathing areas in approved sanitary condition at all times.

During the morning hours, until noon, the pools are free to all children of school age. During the afternoon and evening hours an admission charge is made, being 25 cents for adults and 10 cents for children, which produces income sufficient to pay all operating and maintenance expenses.

The State Department of Public Health has cooperated splendidly in assisting in the design and in operating the pool. Regular reports of the pool, giving the details of each day's operation, are sent to the Departments of Public Health of both the city and the state.

The public swimming pool in Cairo has proved its value as a health builder, recreational center and in protecting and safeguarding the lives of children. During the many years of operation of the old pool, and since the opening of the new one, the records show no accidents or drownings, of which record the community is justly proud.

Installing a Flexible-Jointed Pipe Under a Creek

By B. J. FEITELSON

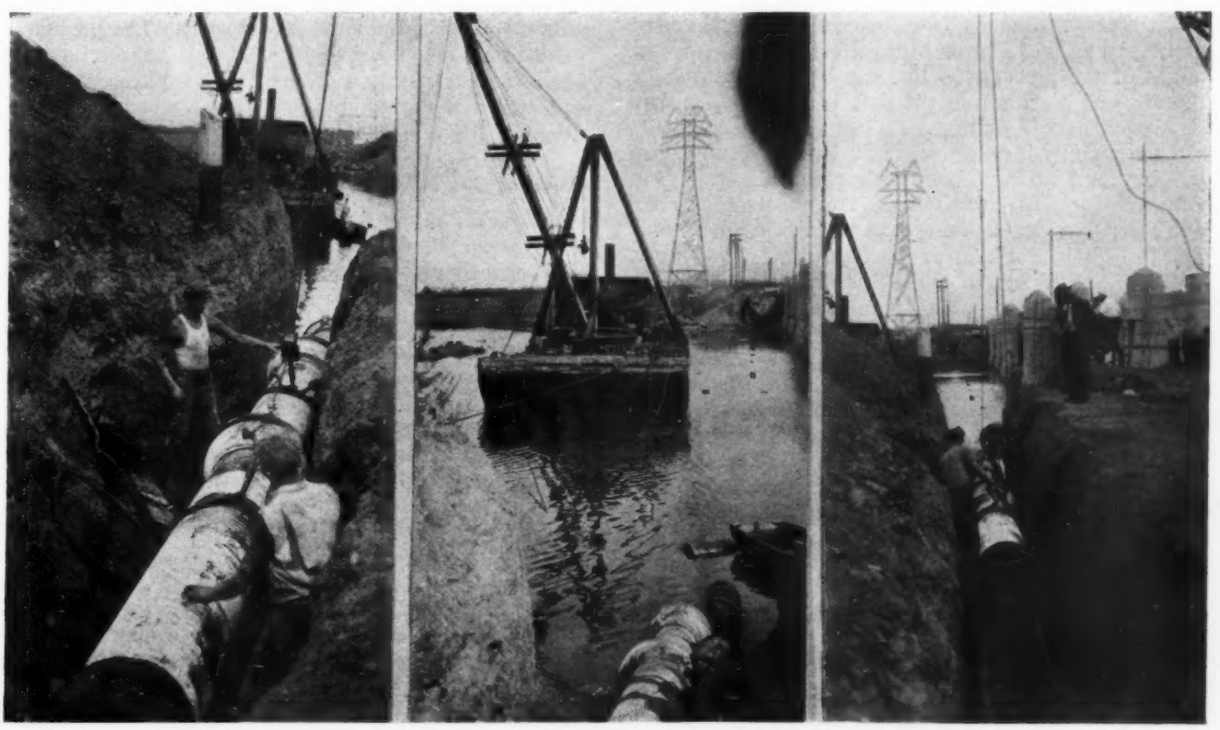
THE laying of a 20-inch water main across Fresh Kills creek, in Richmond borough, New York City, involved several difficulties not common to such construction. The stream is a navigable one, and not only had permission to be obtained from the United States government but it was required that the channel be kept open to navigation during the construction. Also the pipe was laid parallel to the new Fresh Kills draw bridge and only about 15 feet from the faces of the piers, and care was necessary not to endanger the foundations of these.

The creek is shallow, only about 6 ft. deep at mean high tide, and one or two feet at low, with a bottom of soft mud about 5 ft. deep. The Federal government required that the pipe be laid in the navigable part of the creek (about 25 ft wide) to such depth as to give 12 ft. of fill over the bells of the pipe. The pipe on each side of the creek is about 25 feet higher than that in the channel. The creek bed has a flat slope to each bank, and in this the pipe is laid with only 3 to 5 ft. cover, following approximately the contour of the creek bed. The Bureau of Water Supply decided to use a flexible joint pipe and prepared a special design which was believed to insure watertightness while permitting a deflection of 15°. Cast iron pipe is used, lined with cement.

The special joint is a ball and socket, the spherical radius of the ball being 13". After it has been inserted in the bell, it is held in place by means of lead poured in, about 100 lb. to a joint and occupying a depth of 5 11/16 inches; a rib ¾ inch wide on the inside of the bell giving a calking shoulder. This rib and the ball spigot were required to be turned truly spherical and ground and polished. A steel band 1⅜ x 3⅜ inches is shrunk onto the end of each bell to strengthen it. The specifications were rigid and great care was required in their manufacture by the U. S. Cast Iron Pipe Corp., and in handling them until finally laid. It was required that leakage of the completed line do not exceed 4 gal. per linear foot of pipe joint per 24 hours, under 125 lb. pressure.

The contract for furnishing and laying 523 feet of pipe was let to Merritt, Chapman & Scott. The method employed was to dredge a trench for the pipe in the channel from a work barge, and excavate the trench in the banks by a clam shell mounted on a truck. Then the entire pipe line was connected on the south bank and pulled through the trench to the north bank. As the work barge drew considerable water, its first duty was to dredge a small basin in which it could float while working.

When the trench under the water had been excavated to the desired depth, it was close sheathed with steel piling to prevent filling. When the trench in the banks had been excavated to the proper depth and grade, a set of narrow-gauge rails was laid in that in the south bank, which served as skids on which the pipe was assembled, calked, and drawn forward joint by joint. A temporary plug was inserted in the bell of the first pipe, which pointed forward, to keep out the salt water. Before the second length was jointed to the first, both the spigot and interior of the bell were cleaned of their protective coat of grease and tallow and were polished



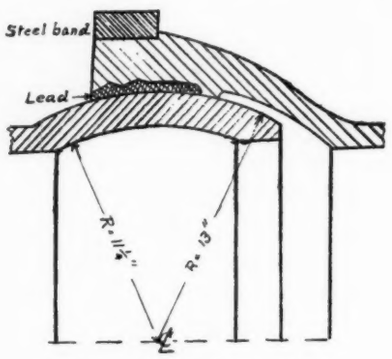
Note rope sling to thrust home the spigot joint

Empty oil drums that buoy pipe are seen on the further side

Pipe on rail skids sliding into the water

Pipe ready for laying, showing spigot balls

with fine emery cloth. The joint was pulled "home" by passing the mainfall, by which the derrick lowered the second pipe, through a pulley attached by a sling to the first pipe. The lead joint was then poured and calked by hand. A steel cable attached around the first bell and operated from the barge was used to pull the first two lengths into the water. For the rest of the distance a derrick engine on the north bank pulled the pipe across. When 24 pipes had been connected up, a double-hub special was placed in the line, so that all bells look upward on both sides of the center of the channel.



Details of ball and socket joint

When about 25 per cent of the pipe had been pulled across, serious trouble was encountered in the shape of submerged piles of a former timber bridge. The extreme weight of the pipe (4400 lbs. per length) caused the forward end to dig into the soft bottom deeper than the trench had been dug. An attempt was made to float the pipe by lashing empty 50 gal. gasoline drums to it, but their lifting capacity was too small, and it was necessary for a diver to saw off the pile below grade. However, four drums were fastened to each length of pipe to lighten the haul as the pipe line grew longer.

When the full length of the line had been laid to the tops of both banks it was connected to the existing regular 20-inch cast iron main on each side by use of a special casting which contained both flexible and regular joints. After these connections had been rodded and braced securely, the pipe was filled by means of a tap located at one end and the entire line subjected to a hydrostatic test of 125 lbs. for a period of 20 minutes. Several small leaks appeared in the form of bubbles on the surface of the creek, but these were caulked by a diver using a pneumatic hammer, when the test met the specified requirements. The sheathing was then removed and the trench backfilled with suitable material, and the banks dressed and restored to their original condition. The contract was completed by obtaining from the U. S. Army engineers a certificate of approval.

The author was construction engineer on this work. Harry S. Wilson (who took the photographs used to illustrate this article) was in charge of the work as representative of the Bureau of Water Supply.

"Mud Flush" Well Drilling in England

In securing water supplies from the lower greensand formation in southeast England, making the deep borings have presented two difficulties: (1) the sudden rush of water and sand on encountering the water-bearing strata, and (2) the difficulty of procuring a constant flow of sand-free water. Recently the so-called "mud flush" system of drilling has been developed to eliminate these difficulties. This method, as used in sinking a 10-inch well 1,100 feet deep and producing a constant free flow of 21,000 g. p. h., is described as follows by "The Surveyor:"

"During drilling operations, colloidal mud was kept in constant circulation, being pumped from the specially constructed mud storage reservoirs on the surface and forced down, under pressure, by means of suitable pumping plant, through hollow drill rods and special drilling bits, whence it is returned to the surface, carrying with it the finely ground residue from the drilling.

"The use of special colloidal mud serves a two-fold purpose: (1) to seal the sides of the bore during drilling, thus eliminating the need for steel lining casing until the final stages of the work, and (2) to hold back, under pressure, any water and "blowing" sand encountered. When the water-bearing sand is encountered and penetrated as far as desirable, special screens are inserted, permitting sand-free water to be delivered. The insertion of the lining screen into its correct position is followed by the gradual demudding of the boring, thus releasing the pressure and permitting the water to flow by natural hydrostatic pressure, bringing with it the mud used during the drilling. Some hours are necessary to enable the water to clear the mud from the borehole and for an effective sand filter to form around the screens at the bottom of the borehole.

"The flow having once started, it is controlled by valves fixed to the well-head in order to produce the supply required for commercial purposes—in the case of Messrs. Horlicks 20,000 gallons per hour are being allowed to flow into storage reservoirs. The boring is lined from top to bottom with steel lining tubes, cemented in where necessary so as to prevent any leakage of the supply into the intervening strata."

When a Materialman is a Subcontractor

Where A enters into a contract with a State Highway Commission for the construction of a paved highway, and thereafter B enters into a contract with A to furnish the sand to be used in the construction of the paved highway, and the contract between A and B is made with relation to the contract between A and the Commission, the Oklahoma Supreme Court holds that B is a subcontractor as well as a materialman. And the assignee of claims of laborers who perform labor for a subcontractor in digging, washing, and hauling sand for use and used in the construction of a paved highway, under the state statute requiring a surety bond for the payment of "all indebtedness incurred for labor or material furnished" for a public project, can recover from the surety. Standard Acc. Ins. Co. v. Basolo, 68 Pac. (2d.) 804.

The Oklahoma Supreme Court is committed to the rule that the surety on the general contractor's bond is liable for gasoline and oil furnished to a subcontractor and consumed in making the public improvement. Standard Acc. Ins. Co. v. Deep Rock Oil Corp., 68 Pac. (2d.) 809.

The Editor's Page

Roadsidewalks

We have coined this new word to designate walkways along highways in rural and semi-urban areas. The need for such construction is emphasized by the incomplete figures that we have of the accidents involving pedestrians. One-third of all rural motor deaths are pedestrians; in the years 1934, 1935 and 1936, 48,100 pedestrians were killed and 840,000 injured in accidents involving automobiles.

Only a few states have constructed roadsidewalks —Massachusetts is probably the leader; Wisconsin has built some in semi-urban and thickly settled rural areas. In some states, the State Highway Department is prevented by law from building such walks. In others, perhaps, the glamor of designing and building superhighways has diverted the attention of the engineers from details just as necessary but not so interesting.

There are also many counties which could and should undertake roadsidewalk construction. Though state highway systems have been expanded and enlarged to take in more and more mileage of highways, there yet remain thousands of miles of important county thoroughfares on which walkways would be a fine investment.

In constructing these walkways, surfacings and bases are made of the same general character as those for highways, but lighter, simpler and cheaper. The technical features offer no problem; nor do design features. Roadsidewalks should be kept off the shoulder; they can follow the contour of the ground, for grades are not important; crossovers can be provided where economy in construction demands it. Local materials and local labor can be employed.

Planning Swimming Pools

This is the season of the year when plans for next year's construction must be considered. This is true of almost every engineering project, but perhaps especially so of swimming pools, for if work can be started early in the season, the pool can be made ready for use when warm weather starts; and if it is not ready then, it means another year of delay, for the swimming season, in the north, especially, is a short one.

This magazine has published several excellent articles on swimming pool design and construction, and during the coming months will publish more of them. It does this because of the large amount of interest on the part of its readers and also because the available information on design and construction appears to be limited. Moreover, if the editors can be of help in forwarding data, they will be glad to be called on.

Synthetic Resins in Sanitary Engineering

From England come reports that synthetic resins are about to solve many of the problems of the sanitary engineer, including the removal of bacteria, dissolved mineral salts and dissolved gases. So far, the data available are non-technical—in other words, newspaper reports. To judge from these, sanitary engineers should be highly interested.

For treatment, according to the reports, passage through two powdered resins is necessary. One converts a neutral into an acid water; the other again neutralizes the water and removes sulphates, chlorides and other salts. The resulting water is said to be as pure as distilled water. Even sea water can be made drinkable, it is said, by giving it this double treatment and sewage can be "purified."

It is often a long and difficult path from the laboratory to the well-working full-size plant, so we don't recommend that you sell your Dorr, Link-Belt, Wallace & Tiernan or other sanitary company stocks at sacrifice prices lest the new processes render them totally worthless.

Another Job for the City Engineer

In the average city, and especially in those of small size, the city engineer is the official who has to carry out the detailed work of city planning—whether he likes it or not. At least so say "Editorial Research Reports." Continuing, this report goes on to say:

"The chances are, too, that this situation will prevail for many years to come because (1) there are not presently available any large number of adequately trained 'city planners' and (2) city officials are still prone to neglect the appropriation of ample money for their hire, even if planners were available.

"Among the 3,100 American cities of more than 2,500 population, 1,700 have planning or zoning accomplishments to their credit, and more than 1,050 have separately constituted planning agencies. But—fewer than 50 of these have appropriated funds to employ technically-trained planning experts. Among the 918 cities over 10,000 population, 658 have planning or zoning accomplishments, but only 25 have employed planning experts.

"This state of facts embodies the fundamental reason why city engineers, in the vast majority of cities, are the only officials with the training and technical skill to mold park systems, roadways, water, sewage and other utility systems, into a unified, effective "city plan."

"It is of the utmost importance that city engineers, in even the tiniest municipalities, should recognize and shoulder their planning responsibility.

"Municipal engineers as a class seem to shy away from direct connection with planning projects, probably because too great emphasis has been placed to date on the aesthetic side of city planning, and not enough emphasis on the practical. In the words of Frederick R. Storrer, city engineer of Dearborn, Mich.: "To me, planning doesn't mean the 'city beautiful' so much as it means the 'city practical.' A practical city will be beautiful because it will wear well. Cities of the future will be forced to realize this."

Given this view of city planning, there seems to be no reason why the city engineer should not feel competent to carry out city planning projects.

Desirable Widths for Two-Lane Roads

THE Bureau of Public Roads has photographed moving traffic, from a car which itself was moving in traffic, to learn the clearance left by vehicles passing each other when moving in the same and in opposite directions. These moving pictures give information valuable not only from the traffic viewpoint but also from that of design, in that they indicate the pavement width necessary for giving desirable clearance in passing. Some of the conclusions of the study are given briefly in the following abstract.

Overtaking and passing a vehicle going in the same direction demands a greater road width than passing an approaching one; partly because in the former case the passing vehicle must speed up, and drivers endeavor to increase clearance as speed increases, while in the latter case this is not necessary—either driver can even slow down if necessary. Also, in same-direction passing, the driver of the passing vehicle must use that portion of the roadway left him by the driver ahead and often can not know for more than an instant beforehand how much that will be. In the great majority of cases he leaves more clearance between vehicles than between his left wheel and the edge of the road, even running onto the shoulder in 18 ft. roads; which he seldom considers necessary in opposite-direction passing.

Passing trucks makes more road width desirable both because of the greater width of the truck, and because trucks tend to travel about a foot inside the center of their lane, while passenger cars generally pull over a few inches to the right of it.

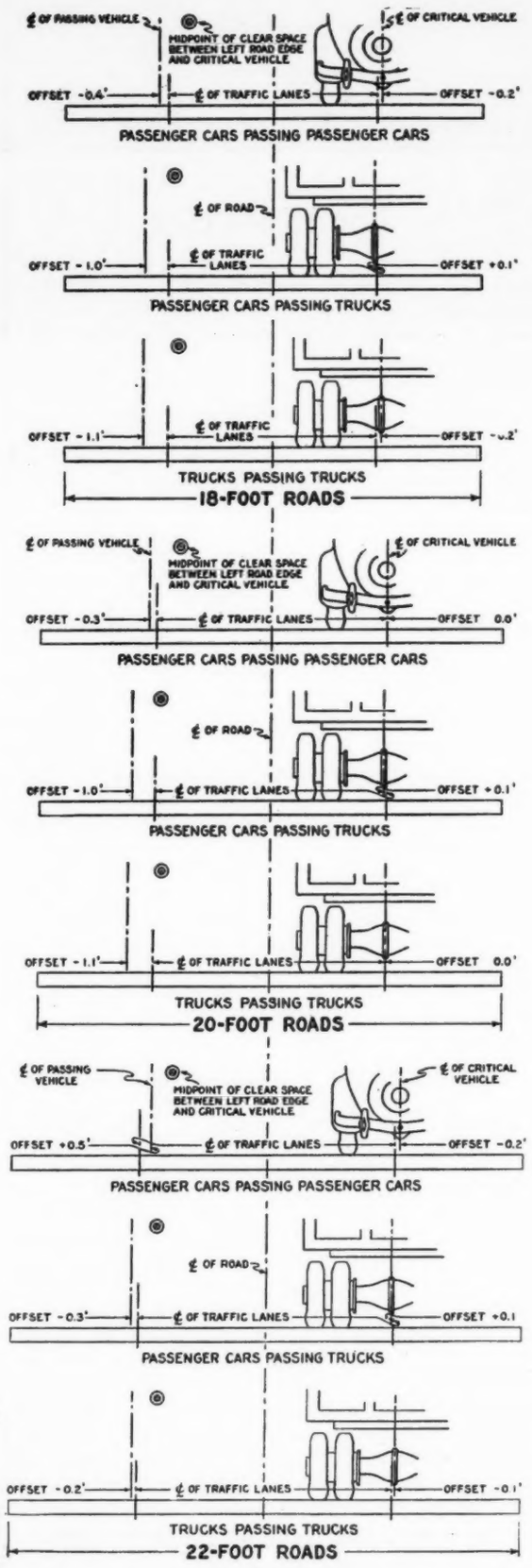
From the hundreds of photographs taken the clearances and other dimensions could be scaled quite accurately. The averages of observations on 18 ft., 20 ft., and 22 ft. roads, and of cars passing cars, cars passing trucks, and trucks passing trucks, are shown on the accompanying illustration. For example, the top diagram shows that when a car passes another car, the passing car moves over until its center is 0.4 ft. left of the center line of the left lane, while the "critical vehicle" (one being passed) draws 0.2 ft. to the right of the center of its lane.

The following general conclusions were reached by the Bureau:

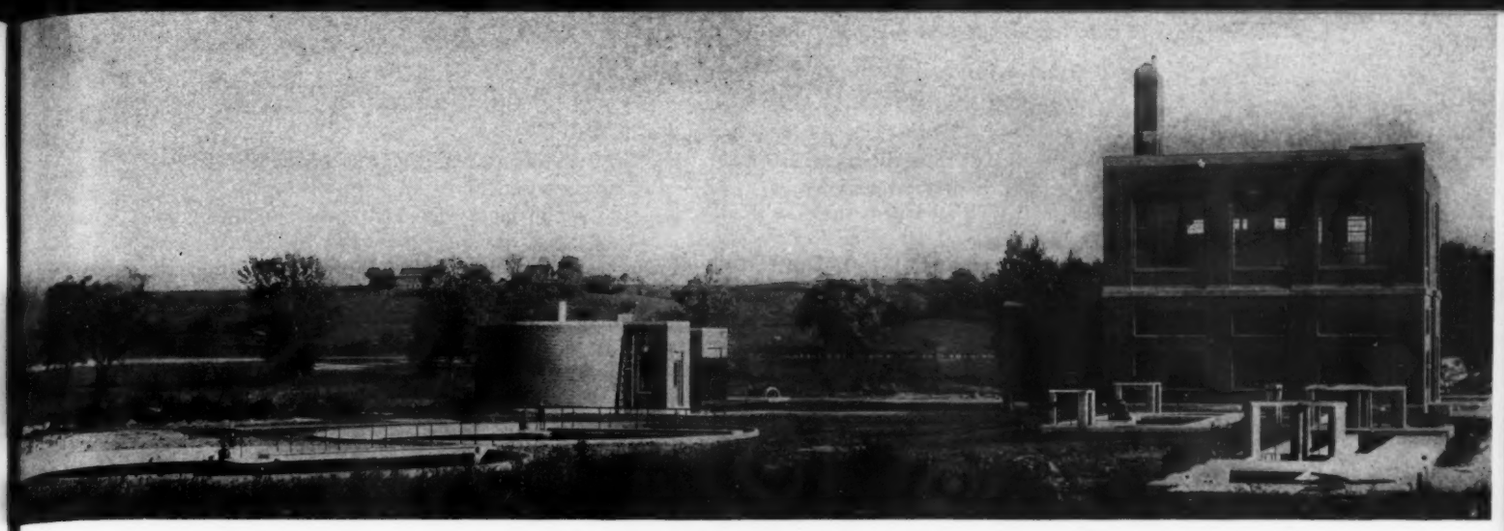
1. Drivers of critical vehicles when being overtaken and passed tend to follow the centerline of their own traffic lane very closely.

2. Pavements of 18-foot width are too narrow for modern passenger cars alone or for modern mixed traffic. Pavements of 20-foot width are reasonably adequate for light-traffic roads used infrequently by wide trucks but are inadequate for heavy mixed traffic. Pavements of 22-foot width are entirely adequate for modern mixed traffic.

3. When passenger cars occupy unfavorable positions with respect to the left road edge in passing trucks, they do so because of the habits of the drivers as often as because of their being crowded over by the passed vehicle.



Position of critical and passing vehicles with respect to centers of traffic lanes and center of midpoint of clear space between left road edge and critical vehicle for same direction passing. Dimensions are weighted averages for physically similar concrete roads. (Without paved shoulders.)



General view of the Kaukauna treatment plant.

Sewage Disposal Project at Kaukauna

By FRANK M. CHARLESWORTH

City Engineer, Kaukauna, Wis.

STREAM pollution in the lower Fox River Valley will soon become a condition of the past. Through the efforts of the State Board of Health and with their guidance, a comprehensive sewage treatment program was started about two years ago and is believed to be one of the largest in any area of this size in the country. The program includes eleven cities and villages, the construction of ten treatment plants and over twenty-five miles of intercepting sewers, with the cost totaling over $5,000,000. All of this work was brought to a head through the offer of the Federal Government to pay 45% of the cost through W.P.A. grants.

The distance from Oshkosh, at the head of the valley, to Green Bay, at the foot, is about 50 miles. The population of the valley is about 140,000, but due to the industrial wastes the pollution load on the river is equivalent to a population of 800,000. By the end of this year, seven of the ten plants will be completed and in operation.

Kaukauna, one of the cities involved, is located about midway in the valley. It has a population of 7,000 and the principal industries are pulp and paper mills. Two years ago it employed the services of Greeley & Hansen, consulting engineers of Chicago, and started the solution of its sewage disposal problem.

Up to date it has built over three miles of intercepting sewers ranging in size from 12 inches to 33 inches. Two miles of this was built in open-cut in solid limestone rock.

About one-half mile of the main interceptor was laid in the middle of the river bed below the dam (where the water is quite low during the summer months), where it flows through the main part of town between banks which slope up to a height of thirty feet on each side, connecting sewers being brought out to the interceptor from both sides of the river. All of the work in the river was in solid rock. Concrete-pipe was used and encased in concrete. Manholes had to be built watertight, as the water rises to a depth of several feet during the high-water period.

Frank M. Charlesworth

Two tunnels, totaling about 400 feet, were built in solid rock under the canal. About ninety per cent of the sewer line was through private property or government property where easements had to be secured and great care taken not to cause any more damage than absolutely necessary.

The treatment plant is completed and about ready to be put into operation. It has a capacity of 4m.g.d., of which it is estimated that ½m.g.d. will be domestic wastes and 3½m.g.d. will be industrial wastes. Due to the large percentage of industrial wastes and their type, pulp mill wastes in particular, it was deemed advisable to build an incinerator type plant. The incinerator selected is the Nichols-Herreshoff, manufactured by the Nichols Engineering & Research Corp, which type of plant was designed to handle the garbage of the city also. The total cost of the project was $308,000, of which the intercepting sewers cost $127,000 and the treatment plant $181,000.

The plant has a gravity flow throughout and is designed for plain sedimentation, but is so equipped that chemical precipitation can be employed. It is made up of the following units,—

1. *Screen & Grit Chamber*—The screen and grit chamber is a rectangular tank with a coarse bar screen and two grit chambers. This unit is cleaned manually. The sewage can be passed through one grit chamber while the other is being cleaned or it can be by-passed around this unit entirely.

2. *Flocculator Tank*—If the sewage is to be treated chemically, it is taken to the chemical building, where the necessary chemicals are added, and then brought to the flocculator. This contains a super-mixer manufactured by the International Filter Co. which mixes the chemicals and sewage thoroughly before passing on to the settling tanks. If the

sewage is not to be treated, it passes directly from the grit chamber to the settling tank. Going either way, it passes through a venturi meter which measures the flow and electrically records it in the operator's office.

3. *Settling Tanks*—These are equipped with Dorr clarifiers, 50 feet in diameter, having scrapers on the bottom and scum blades at the top of the liquid. The bottom of the tank is conical in shape and the scrapers move the sludge to a center sump from which it is drawn to the sludge building. The whole mechanism is mounted on a center pier. The scum is taken from the tank through a 4-inch line to the sludge building.

4. *Chlorination Building*—The effluent from the settling tanks passes through this building, which contains a Wallace & Tiernan chlorinator.

5. *Contact Tank*—This tank is rectangular in shape and has three baffle walls over which the effluent passes and is mixed with the chlorine before going to the river.

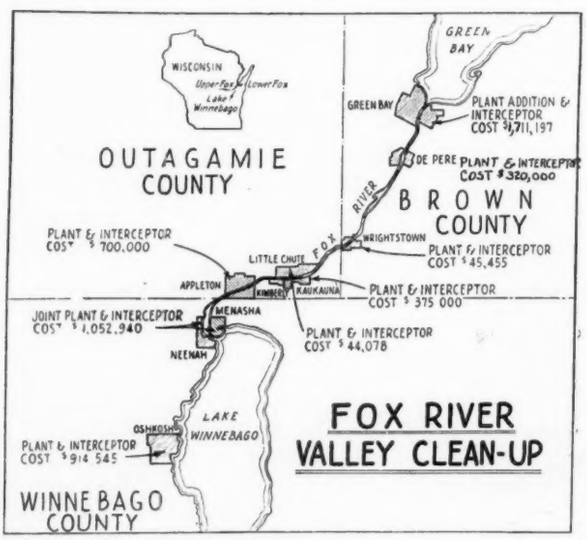
6. *Sludge Storage Tank*—This is just a concrete tank in which to store the sludge when the incinerator is not in operation.

7. *Chemical & Sludge Building*—This is the main building and contains the following units,—office, labratory, sludge well, filter, incinerator, garbage handling equipment, chemical storage and space for chemical feed machines.

The sludge from the settling tanks or from the storage tank is pumped to the sludge well, from which it is removed by a bucket conveyor to the chemical mix tank. In this tank ferric chloride and lime are added for the purpose of coagulating the sludge so as to keep it from passing through the filter cloth. The sludge, containing about 95 % moisture, flows from the mixing tank to an Oliver filter, the sludge cake from which contains about 66% moisture. This sludge cake is conveyed by a horizontal belt conveyor to the incinerator.

The incinerator, briefly described, is a circular four-hearth air-cooled unit of refractory material enclosed by a shell of steel. Heat necessary for incineration is furnished by the combustibles in the sludge, supplemented by three oil burners, used only when necessary. The sludge is burned to a clean ash which is conveyed by elevators to a storage tank out of which a chute discharges it into trucks.

Garbage is brought to the plant in trucks and dumped into a hammer-mill grinder, which shreds it.



Map of the Fox river.

By means of an elevator and screw conveyor this garbage can be disposed of in any one of four ways: If dry enough, it can be elevated directly into the incinerator; if not quite dry enough, it can be elevated into the sludge well where it will pass through the filter with the sludge before going to the incinerator; if the incenerator is not operating, it can be conveyed to the sludge storage tank. It can also be conveyed to the settling tanks, where there is a possibility that it may help the action of settling out the solids in the sewage.

A test or try-out of the incinerator will be conducted by the contractor (Nichols Engineering & Research Corp.) for a period of ninety days, to prove compliance with the specifications before the city will accept the equipment.

Harry E. Heck, of the firm of Greeley & Hansen, was resident engineer and Herbert Haas will be chief operator.

Traffic or Zone Paints

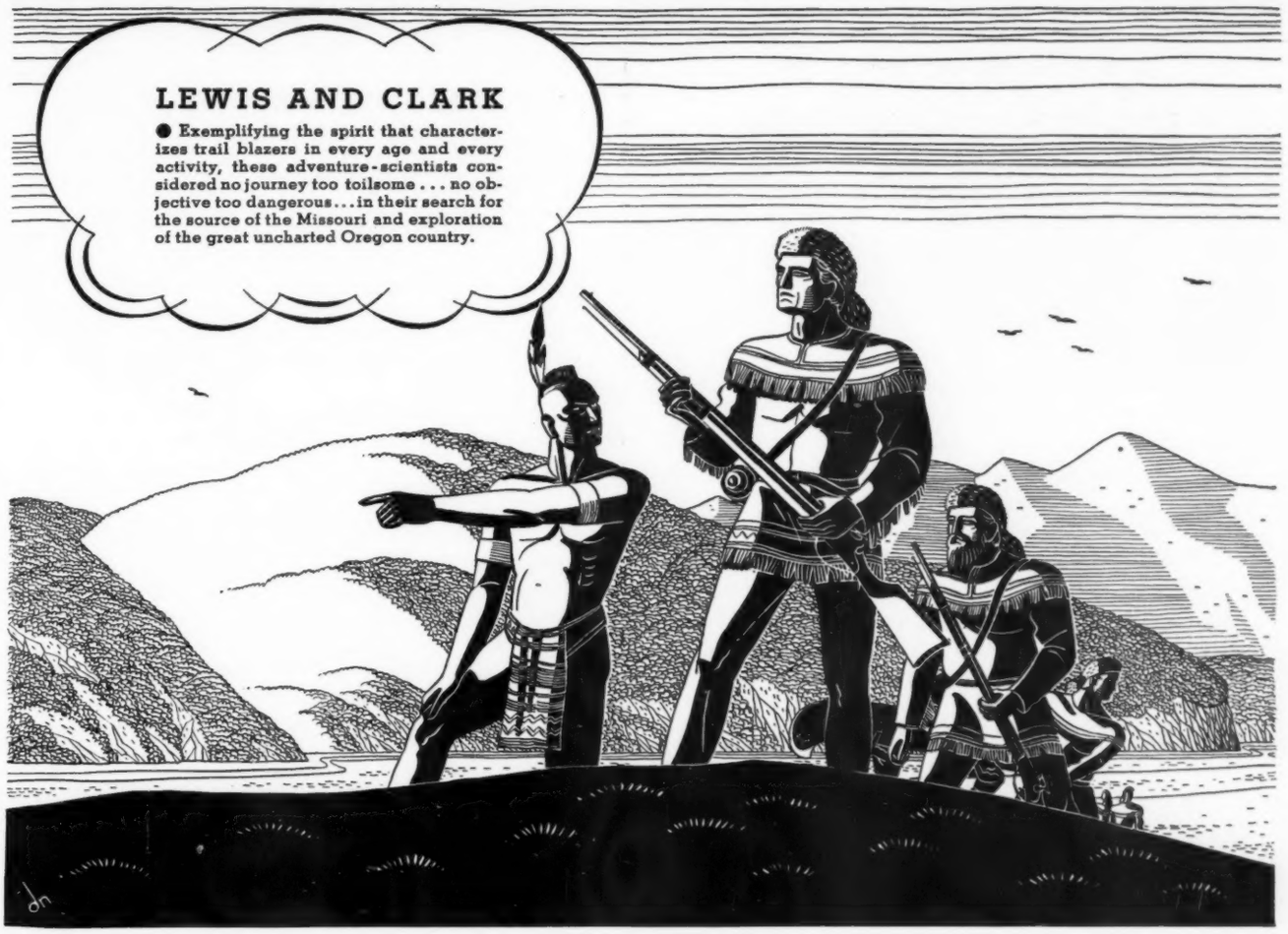
Owing to the ever increasing number of automobiles, the subject of traffic or zone paint is becoming more important. The painting of surfaces of highways to designate lanes of travel, and the marking of crosswalk boundaries, parking spaces, special directional lines, curbs, obstructions, etc., are coming into more general use. These markings are of great assistance to a driver, and tend to promote the safety of both driver and pedestrian. For special purposes, particularly in heavily congested traffic areas, round and rectangular inserts of aluminum, non-rusting steel, monel metal, brass, etc., are used with good results. However, paint is more extensively used because it can be cheaply applied and readily renewed. Many thousands of dollars are spent annually by States and municipalities in buying and applying traffic paint. These paints are of a different type from ordinary paints and vary greatly in durability. Since the cost of application is two or three times the cost of paint, a method of testing which will determine relative durability may result in large savings to the public.

In cooperation with the District of Columbia, the Bureau of Standards has been testing traffic paint for the past 10 years. Experience has been gained from actual road tests of a large variety of both commercial and experimental paints. This has led to the development of specifications, and a machine for measuring the relative wear of traffic paints. A distinct improvement in durability of the traffic paints in actual service has resulted. A publication on this subject will appear as a Circular of the Scientific Section, National Paint, Varnish and Lacquer Association, Inc., 2201 New York Avenue, N. W., Washington, D. C.

Winter Care of Hydrants in Brookline

W. B. Bushway, superintendent of water works of Brookline, Mass., in his annual report for last year, states that all hydrants and hydrant gates were serviced during the year, and at low temperatures all hydrants holding ground water were inspected and pumped out several times daily as long as the frost remained in the ground. During the coming year it is intended to connect these hydrants to a permanent drain.

Hydrants in exposed locations or apt to be covered by snow drifts were marked by a pipe, painted and stamped, which was driven into the ground nearby.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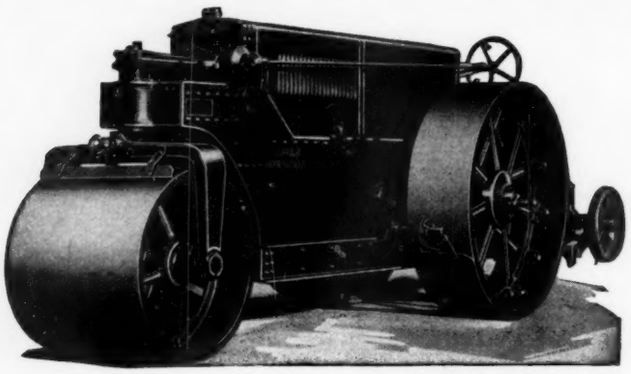

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Fine, Dry Sand Makes Grading Difficult

By BEN J. PINSONNEAULT

The grading program of Red Lake County, Minn., for the year 1937 was very small but included one very interesting job—the grading of 3.3 miles of State Aid Road No. 1, located in the extreme west end of the county. The project begins at the west line of the county, where we are using an abandoned railroad grade for a part of our roadway for a distance of two miles, crosses Pembina ridge (a part of the shore of Lake Agassiz) and then runs east a distance of one mile where it joins a graded road leading to Red Lake Falls.

The contractor got along pretty well with the work on the old railroad grade and with mile of grade running east, but the 0.3 mile of fine sand across Pembina Ridge proved to be a sticker. It just would not elevate or be moved into place. Finally Providence stepped in with several heavy rains which gave the sand just enough cohesion so that it could be put into place and shaped. Immediately after the roadway had been bladed and the slopes completed, we gave the whole section a coating of 6″ to 8″ of clay and top-soil. The last step was graveling the 24′ roadway with 1,000 c.y. of material per mile

Tar Macadam Surfacing in Use for 27 Years

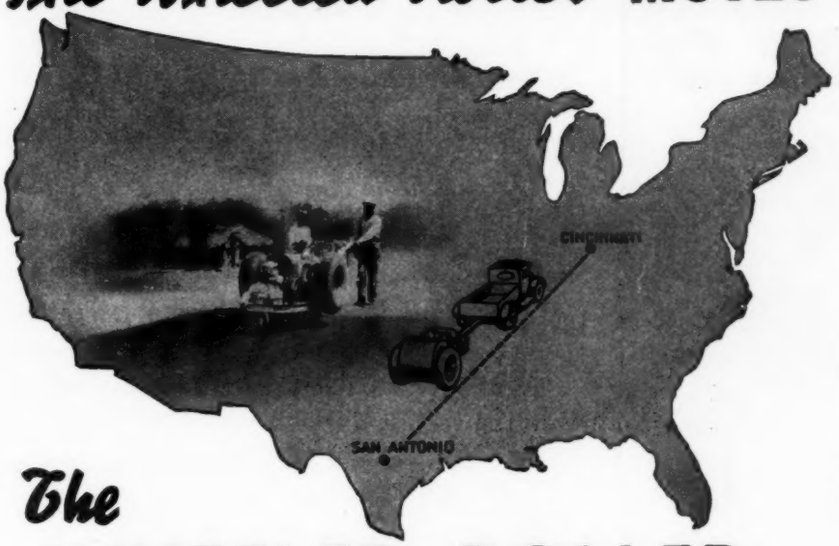
The tar macadam surfacing described was constructed in south-western Germany in 1910, and received periodical surface dressing. The removal of samples for examination early in 1937 proved difficult, owing to the degree of consolidation that had been attained. The surface was close-grained and non-skid; the stone chippings which had been applied in the course of surface dressing were firmly held in place. Successive treatments had not resulted in a stratified structure. The aggregate appeared to be completely coated, and there were no visible voids.

The satisfactory behavior of the surfacing is attributed to (a) the nature and grading of the aggregate; the stone was roughly cubical in shape, with sharp edges, and there was little evidence of crushing; (b) the properties of the binder, which consisted of a 94.2: 5.8 per cent. tar-bitumen mixture and appeared fresh and capable of effective retention of the aggregate after prolonged service.

The properties of the sample are summarized as follows:—thickness, 2.4 in. to 3.2 in. (orginal thickness, 4 in.); sp. gr., 2,669; water absorbed in vacuo, 1.09 per cent. by weight; void content, 2.9 per cent. by volume. *Aggregate grading:* passing 2.4-in. opening, retained 2-in., 9 per cent.; passing 2-in., retained 1.6-in., 15 per cent; passing 1.6-in., retained 1.2-in., 6 per cent; passing 1.2-in., retained 0.6-in., 14 per cent; passing 0.6-in., retained 0.2-in., 23 per cent; passing 0.2-in., retained 0.04-in., 19 per cent.; passing 0.04-in., 14 per cent. Void content of vibrated and tamped aggregate—23.6 per cent. *Binder:* total, 5.8 per cent. by weight or 12.5 per cent. by volume; soluble, 5.3 per cent. by weight or 11.8 per cent. by volume. Drop-point of extracted binder, 22.5° C.; brittlepoint (Fraass), below—21° C. This surfacing, which was originally of an "open" type, has become consolidated under traffic until its properties are comparable with those of surfacings designed on the "minimum voids" principle.

OHSE: *Mitteilungen der Auskunft-und Beratungstelle für Terrstrassenbau. Road Abstracts.*

The Wheeled Roller MOVES TO LITTLEFORD



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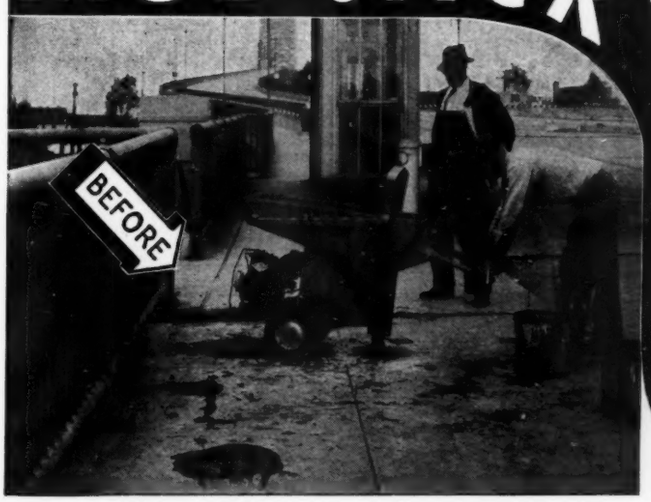

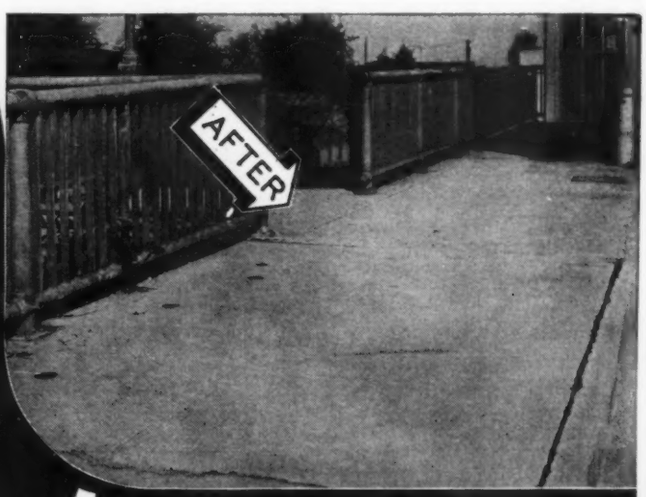

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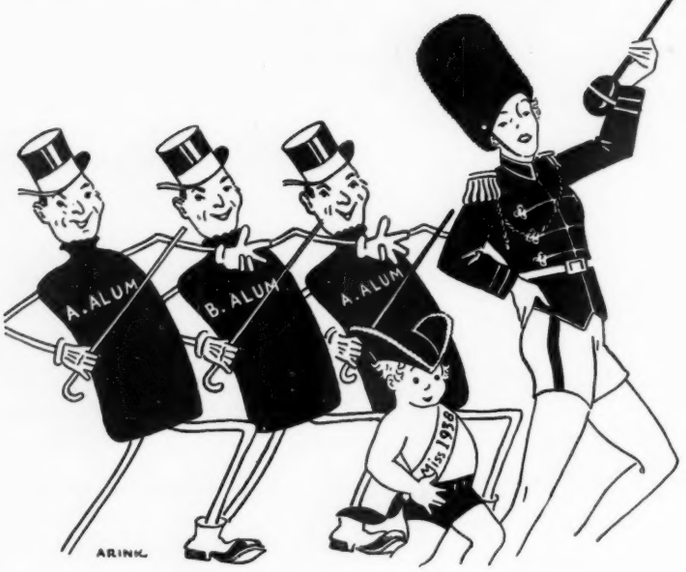

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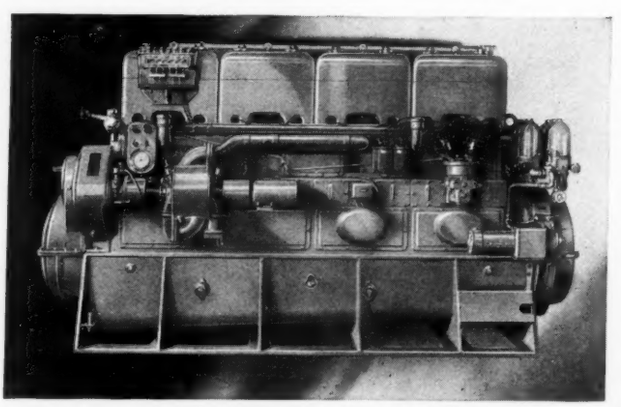

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Turn to pages 51-53 for descriptions of helpful booklets and catalogs.

Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.

The Water Wheel

Back-siphonage in plumbing systems is caused, more frequently than most realize, by vacuum in water pipes due to inadequate size or corrosion in house piping or a break or shut-off in street mains. This may cause back-siphonage from toilet bowls and urinals; bathtubs, lavatory basins, sinks, laundry trays or drinking fountains with under-rim inlets; ejectors for sewage and cellar drains, refrigerator drains, condensers, dish washers, laundry equipment, hospital and laboratory equipment, swimming pools, etc. It can be prevented by venturi or funnel air breaks, check valves, or tanks with above-rim water inlets.[B28, 29]

Gypsy moth caterpillars show a decided preference for oaks, gray birch, poplar, apple, alder, basswood, willow and hawthorn trees, and these could well be omitted or removed from watersheds. Ash, locust, tulip, black walnut, red cedar and balsam fir are seldom infested by them. Creosoting egg masses, banding trees and spraying foliage are only palliatives and their cost would soon exceed the forest values they aim to protect. Removal of all susceptible trees and encouragement of the non-susceptible seems to be the best procedure.[B23]

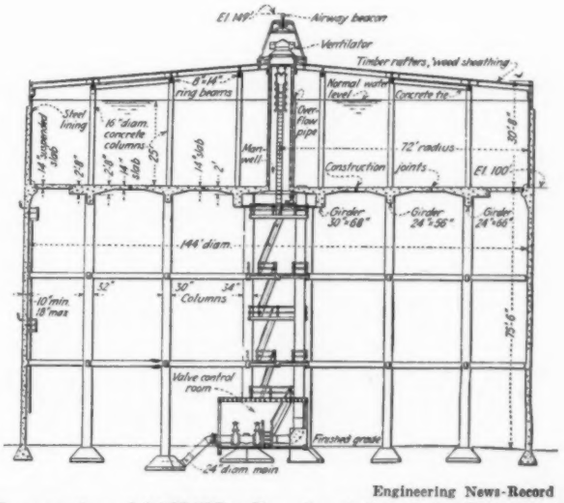
Meters should be chosen to suit the service, not only as to size but also as to type. A laundry or irrigation line requires a velocity type meter; a school, shoe factory, etc., a displacement (disc) meter. A leather factory or lamp factory, a compound meter. (Demand in a leather factory may be 500 gpm and a little later only 5 to 20 gpm). As to size, estimate that needed, and after it is in service, connect a meter master for a week, charting consumption rates and demand periods, and from this judge whether it is too large or too small. Large meters should be by-passed and so gated that they can easily be tested in the line. If they have to be removed to be tested they seldom will be.[B24]

Rating municipal supplies has been adopted by the Texas Department of Health by which satisfactoriness of a supply is indicated by a percentage. Ex. covering a reservoir counts 8 on a scale of 100; having a licensed operator counts 8 (licensing is voluntary in Texas). Three years was taken to develop a satisfactory formula. Of 499 cities rated, the average grade at first inspection was 35; a second inspection, following recommendations for changes, gave an average of 75. When a rating exceeds 92, the town is permitted to erect highway markers stating the State's approval of the supply; 29 towns have received this permission so far.[E49]

Organic exchange filters consist of organic materials of "acidic" and "basic" types combined with suitable mechanical equipment. The acidic exchanger contains one or more active hydrogen atoms. When a salt solution is passed through it, the ions of the salt combine with the organic material and release hydrogen ions, which form hydrochloric acid if the salt was sodium chloride, sulphuric acid if it was calcium sulphate, etc. When the exchanger has been saturated with sodium, calcium, etc., it is regenerated by use of a weak acid such as a 1% sulphuric acid solution, which is then passed through the basic exchanger to remove the acid, this exchanger consisting of "large insoluble molecules having ionized hydroxyl groups." Most of the equipment used must resist acids, and part of it resist caustic soda. A surface water containing 36.8 gr. per gal. of dissolved solids, including 12.6 gr. of sodium sulphate, can have dissolved solids reduced to 1.5 gr. by this process at a cost of $350 per million gallons.[A157]

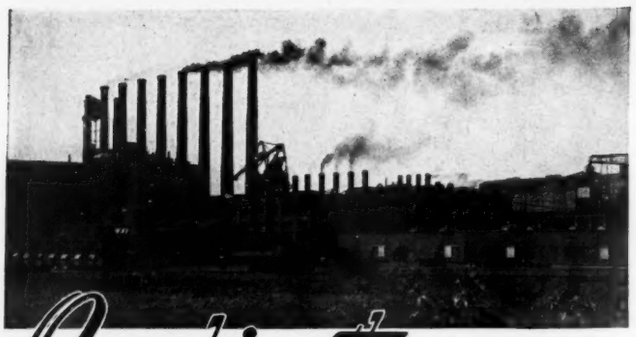
Sand expansion in filter bed washing has been measured at Allentown, Pa., by means of a float, counterweight and indicator, the float remaining at the surface of the sand as it rises. The counterweight should weigh about 87% as much as the float, but this varies with the kind of filter medium; water temperature and depth do not affect the accuracy. The float was in the shape of a cone with a convex base loaded with lead, the specific gravity somewhat exceeding 1.7. The sides of the cone must be steep enough to prevent sand lodging on them—45° was adopted for sand, 51.4° for coal, and a 100mm. diameter for the base.[G35]

Concrete tanks, elevated 75 ft. above the ground and holding 3,000,000 gallons each, have been built in Sacramento. Each of the two tanks is 144 ft. inside diameter and 26 ft. height of water; the side is lined inside with a welded steel shell capable of withstanding the water pressure alone, the enclosing reinforced concrete affording a factor of safety against earthquakes and being anchored to the steel by anchor bars welded on 3 ft. apart. The floor is a combination of reinforced concrete ring girders and haunched floor slabs with copper water stops across all joints. The tank wall is continued vertically to the ground as a support for the



Engineering News-Record

Cross-section of 3,000,000-gallon elevated tank for Sacramento, Calif.



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tank, additional support being furnished by 44 concrete columns arranged in three concentric rings. A well 6 ft. in diameter in the center of the tank gives access to the tank and its roof. The cost was less than the estimate for structural steel tanks of the same capacity.[E53]

Iron in ground water pumped from 88 driven wells at Attleboro, Mass., was thought to be washed from the sandy, gravelly aquifer, which was coated with iron, by the high velocity of 67 ft. a minute; also that much of the iron was washed from the top soil by percolation. Large gravel-packed wells were substituted, giving entrance velocity of only 2½ in. per minute; about 20 in. depth of top soil was removed from the 2-acre well field; intermittent high-rate pumping was discontinued. Thus the iron content of the water was reduced from 0.98—1.94 ppm to 0.15 ppm.[F113]

Percolation through earth dams is an indeterminate process; the use of models is subject to grave limitations. "It is thought that there is little promise that either analytical treatment or model tests will ever yield significant results. Even careful observations of seepage in completed structures will seldom be applicable to new structures, because of the wide variety of conditions encountered."[K9]

Zeolite softening is conservatively guaranteed to remove 2,800 gr. of hardness per cu. ft. of mineral when regenerated with 0.4 lb. of salt per 1000 gr. of hardness removed, but usually runs from 3,000 to 4,000 gr. Increase in hardness tends to reduce exchange capacity. The entire sand bed must be kept loose and free so that there is no channeling, if good exchange values are maintained. A completely drained unit should never be filled from the bottom at a rate greater than 2 g.p.m. per sq. ft. With some waters carrying manganese, crenothrix forms a yellow liver-like coating on the sand, prevented by applying chlorine to the raw water at 0.7 p.p.m. Continued softening had no effect on the salt rate at Sewickley, Pa., after 8 yrs. service. Backwashing after each regeneration gives longer runs and better salt rates. Immediate change from hard to soft water may cause dysentery in consumers; better to change gradually. A demanganizing filter designed for 10 g.p.m. per sq. ft. upward flow gave nearly as good results at 20 g.p.m. upward as at 2 g.p.m. downward; used 1.78 to 1.10 lb. of potassium permanganate per pound of manganese removed; cost $3.60 per m.g. of water in which manganese was reduced from 1.3 p.p.m. to 0.09.[A156]

Bibliography of Recent Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with the January issue.

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article

A *Journal, American Water Works Ass'n*
October

151. Progress and Developments in Dams, Supply Lines and Pumping Equipment. By L. R. Howson. Pp. 1429-1437.
152. Two-Inch Cast Iron Pipe. By J. D. Sample. Pp. 1438-1442.
153. Treatment and Purification of Water: Progress and Developments During 1936. By Paul Hansen. Pp. 1443-1466.
154. Boiler Feedwater Studies: Report of Joint Research Committee. Pp. 1467-1471.
155. A Study of Contemporary Zeolites. By L. F. Collins. Pp. 1472-1514.
156. Observations on Zeolites in Water Softening and Demanganization. By D. E. Davis. Pp. 1515-1525.
157. Removal of Dissolved Mineral Solids from Water by Organic Exchange Filters. By P. G. Bird, W. H. Kirkpatrick and E. Melof. Pp. 1526-1532.
158. Coagulation as Applied to Industrial Waters. By A. P. Black, R. A. Bardwell and B. W. Graham. Pp. 1533-1547.
159. Diversified Activities of Our Water Sales Division. By T. M. Erwin. Pp. 1548-1559.
160. Creating and Retaining Customers' Good Will. By H. L. Meites. Pp. 1560-1565.
161. Internal Audit and Control. By P. D. Williams. Pp. 1566-1579.

162. Can a Municipal Waterworks Be Economically Operated? By W. R. La Due. Pp. 1580-1590.
163. Some Notes on Sand Filtration. By T. Iwasaki. Pp. 1591-1602.
164. Experiences with Activated Carbon at Hammond, Ind. By L. Besozzi and J. C. Vaughn. Pp. 1603-1639.

E *Engineering News-Record*
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53. Elevated Concrete Tanks of Record Size. By H. D. Dewell. Pp. 752-755.

F *Water Works Engineering*
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114. Repair and Maintenance Methods at Lowell, Mass. By N. N. Wolpert. Pp. 1540-1543.
115. State Ownership of Water Claimed by Pennsylvania. By J. F. Bogardus. Pp. 1544-1545.

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116. Bone Contact Removes Fluorine. By H. V. Smith and M. C. Smith. Pp. 1600-1603.

G *Water Works and Sewerage*
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35. ρ. Measuring Sand Expansion in Filter Wash Control. By H. J. Krum and E. M. Jones. Pp. 373-376.
36. A Fully Automatic Softening and Iron Removal Plant. By R. F. MacDowell and H. L. Beohner. Pp. 377-381.

J *American City*
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22. Trans-Mountain Water Diversion for Denver. By A. A. Matthews. Pp. 58-60.
23. Water Supply for the World's Fair (New York). P. 68.
24. Winter Protection of Waterworks Plants. Pp. 81, 83, 85.

K *Proceedings, America Society of Civil Engineers*
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9. Laws Governing Percolation Through Earth Dams and Their Foundations. By B. Koerner. Pp. 62-67.

M *Canadian Engineer*
November 2

27. Some Recent Installations of Continuous-Stave Wood Pipe. By E. J. Cousens. Pp. 7-10.

P *Public Works*
November

51. Subterranean Reservoir at Billings, Mont. By A. L. Hewitt. Pp. 15-16.
52. Cleaning a Rapid Sand Filter with SO_2. P. 18.
53. Building Porous Concrete Wells. By J. A. Raffield. Pp. 34-35.

W *Johnson National Drillers Journal*
September-October

4. Removal of Iron from Water. Pp. 1-5.
5. Modernization of Public Waterworks. By M. F. Kocherginsky. Pp. 6-7, 11-13.

Right of Material Men to Sue on Contractor's Bond

A bond given by a public improvement contractor to a municipality which provided that it was for the benefit of any materialman or laborer having a just claim as well as for the named obligee, and that the surety's liability for any and all claims should not exceed the penal amount of the bond showed the intention that the material men and laborers were direct beneficiaries, the Pennsylvania Supreme Court holds (Concrete Products Co. v. U. S. Fidelity & Guaranty Co., 310 Pa. 158), and therefore material men furnishing pipe to the contractors for storm sewers could maintain an action on the bond, even in the absence of a statute or ordinance authorizing suit by such materialmen.

"Notice to Bidders" Must Be Complied With

Municipal authorities cannot waive any substantial variance between the conditions under which bids are invited and the proposals submitted, the New Jersey Supreme Court holds (Tufano v. Borough of Cliffside Park, 165 Atl. 628). That court holds that a trucking company which did not submit with its bid for the borough garbage removal contract proof of ownership or a written lease of a dumping ground and municipal consents to the transportation of garbage through other municipalities to the place of deposit was not entitled to an award of the contract.

Under the New Jersey statute, the lowest bidder is one whose bid is not only the lowest for the work to be done or the articles to be furnished, but who conforms to the requirements of the notice to bidders.

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A Digest of the Important Articles in the Current Sewage Literature of the Month

The Digestion Tank

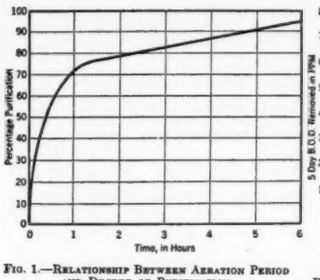

FIG. 1.—RELATIONSHIP BETWEEN AERATION PERIOD AND DEGREE OF PURIFICATION

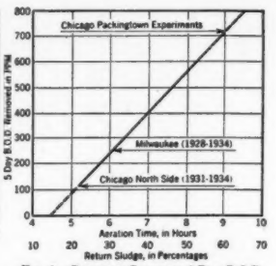

FIG. 2.—RELATION BETWEEN 5-DAY B.O.D. REMOVAL AND (1) AERATION PERIOD, OR (2) PERCENTAGE OF RETURN SLUDGE

Studies in aerating activated sludge.

Aeration tank capacity depends upon quantity of sewage to be treated, percentage of return activated sludge, and aeration period. Fig. 1 is typical of relationship of aeration period to degree of purification (after clarification). The rapidity of coagulation absorption at first is proportional to the percentage of returned sludge; but a large amount of sludge later robs the sewage of oxygen, while too small an amount (or very strong sewage) necessitates reaeration of sludge. Fig. 2 is an attempt to give a practical guide for approximating the detention period and percentage of return sludge in designing tanks. It may not apply to trade wastes high in B.O.D. Reaeration of sludge is required with partial treatment; also if the aeration period is kept at a minimum and percentage of return sludge is too small.

A depth of tank of 15 ft. is generally the economic maximum. Good operating results have been obtained with 10 ft. The greater depth is favored by weak sewage, cheap power, high construction costs, and costly land. Air compressor power can be reduced by placing diffusers near mid-depth and mixing mechanically. A width of twice the depth seems to be the maximum with diffusion plates on one side only.

The amount of air required per ppm. of 5-day B.O.D. removed is 0.0038 to 0.0054 cu. ft. per gallon for spiral flow tanks, 25% more for ridge and furrow-type. Preliminary sedimentation has little effect on this. Strong industrial waste probably requires more. With combined air diffusion and mechanical agitation, air may be reduced 75% and total power 50%. One to 4 cu. ft. per min. per sq. ft. of diffuser plate seems to be the limit; 4 to 6 cu. ft. per ft. of channel suffices for tank 15 ft. deep by 30 ft. wide.[K3]

Activated sludge pH is to be adjusted by means of digestion tank gas at Kyoto, Japan. Due to dye wastes, the pH of the sewage averages 8.70 for five hours a day, ranging from 6.2 to 9.2. To reduce this to 7.0 would cost $4.80 a day using sulphuric acid, $24.30 using ferric sulphate, $33 using alum, $43 using ferric chloride, and $108 using commercial carbon dioxide. But the exhaust from the digestor gas burned for heating the tank contains 5% to 10% CO_2 (the unburned gas averages 33.7%), and 18% of the gas produced would suffice for maintaining the pH at 7.0, being mixed with the sewage for two minutes by means of a turbo-mixer. This requires about 8 hp. for operation, which costs about 18 cents a day for current, while the installation cost is small.[C67]

CO_2 production in activated sludge treatment is suggested as a substitute for B.O.D. measurements for some purposes. The experiments indicated that CO_2 production from mixtures of sewage and activated sludge "might be a more reliable way of determining the load on the aeration tank than B.O.D., because CO_2 measurements are made under conditions more comparable to the aeration tanks than B.O.D. measurements. The method is simple and inexpensive in contrast to other existing methods which might be used for the same purpose such as the Barcroft differential manometer and the Nordell machine." The experiments showed that generally the highest rate of CO_2 production occurs during the initial period; also that the duration of a high rate of production is dependent on the strength of the sewage. "The theoretical aspect of the findings emphasizes the importance of oxidation during the clarification stage and points out that biochemical oxidation systems in the activated sludge have the potentiality, with proper stimulation in the presence of food and air, to react rapidly without any lag."[C64]

Toxic wastes affect sludge digestion, generally unfavorably. In mesophilic digestion, poisons such as sodium arsenate and copper sulphate retard digestion, even in small quantities, affecting gas production more than liquefaction. Rate of sludge dewatering may or may not be reduced, depending on type and quantity of poison. Oils such as crank case waste stimulate gas production but increase digestion time and greatly reduce dewatering. Gasoline in even small quantities (1% on fresh solids basic) reduces gas production and increases digestion time. Acids in small quantities have little effect on gas production and digestion time, but produce more odors; in larger quantities they practically inhibit digestion or prevent gasification, changing the process to liquefaction. Sewage sludge appears to be capable of limited "acclimatization" with poisons, and more with oils. Thermophilic digestion is more sensitive to poisons and less to oils and acids, than mesophilic, produces less gas, and drainability is poorer.[C65]

Four-stage digestion of sewage sludge has been operated by the Los Angeles County Sanitation Districts since July, 1931, and studied since April, 1933, this paper giving results to April 30, 1937. Two batteries contain 4 tanks each, each tank divided longitudinally into three equal bays by two curtain walls extending from the roof to within a foot of the bottom. The liquid surfaces are 3 ft. lower in each of the successive tanks. Sludge is introduced into the outer bays of tank No. 1, settles and slides under the walls to the middle bay, and down the sloping floor of this to a hopper; from this it goes to the outer bays of No. 2 and repeats the process in each successive tank, finally entering an open pit, from which it is drawn onto drying beds. Temperature in tank No. 1 is kept at 85°. The sludge is 33% primary and 67% activated, average solids content 4.7%; quarterly averages of amounts run 122,000 to 160,000 g.p.d. To raw sludge, as it is introduced, is added 20% digested sludge, generally from the pit. Detention period about 8.5 to 11 days. Average reduction of organic matter, 47%. Dried satisfactorily without nuisance.

Conclusively determined that agitation by mechanical equipment is not needed. Probably controlled seeding of raw solids is a factor in efficient digestion. Design of tanks permits large accumulation of scum without reducing efficiency. There is no appreciable liberation or absorption of heat during digestion. The presence of large quantities of iron salts apparently has no deleterious effect on digestion and is beneficial in keeping H_2S at a very low value. No nitrogen is lost in digestion—part is dissolved in the sludge liquor, that remaining in the solids is approximately proportional to the organic matter remaining. Gas from 1st stage was 47% of all that produced and its fuel value but little less than that from the others.

After 25 months, scum was largely composed of semi-permanent, indigestible matter; screenings of scum through an 8-mesh screen equaled 12% of all sludge solids in the tank. After 30 mos. service, heating coils were covered with 0.5 in. of limey scale and transmitted heat at the rate of 84 B.t.u. per day per foot of pipe per degree of temperature differential, but after the scale was removed the rate was 347 B.t.u.[K4]

B. O. D. per capita of domestic sewage varies somewhat but is fairly uniform, and is valuable in estimating stream pollution, treatment plant requirements, etc. To determine it requires accurate figures for contributing population, amount of sewage, and average B.O.D. (total or 5-day). The 5-day B.O.D. for 19 Ohio cities for five years have been obtained and studied. The average for 14 cities of over 5,000 population was 0.172 (ranging from 0.142 to 0.221), and for 5 cities of under 5,000 was 0.158 (ranging from 0.115 to 0.233). These are increased in most cases by industrial wastes. In Norwalk, with an average of 0.174, it ranged from 0.113 to 0.209 in 1934, the latter being due largely to corn wastes in August and September, while milk wastes increased it during other months.[C68]

Vacuum filtration is affected adversely by stirring of the sludge. The experiments indicated that stirring the sludge (1600 r.p.m. up to 20 min.) before coagulation reduced the rate of filtration, and stirring it for any appreciable time after the coagulant had been added reduced it still further. Allowing coagulated sludge to remain quiescent before being filtered in general reduced the rate in the case of raw sludge but increased it in the case of semi-digested and digested sludge.[C66]

Hat factory waste in the sewage of Danbury, Conn., contains 6 to 30 cu. ft. per hour of waste fur which felts sewage solids so that, when treated on 13.5 acres of sand filters, 7 men were engaged solely in scraping and resanding them. When settled and pumped to digestion tanks, fur scum formed 30 in. thick and would not digest. Bar screen had to be cleaned hourly. Finally fine disc screens with 1/32 inch slots were installed and proved satisfactory, removing up to 240 cu. ft. of screenings in 8 hours; but some fur gets by, and 2 cu. yd. of scum per week is removed from the digestion tanks. Effluent to the sprinkling filters passes through screens of ¼ inch mesh, which are cleaned 3 times a day.[H43]

Sprinkling filters 15 ft. diameter with stone 3 ft. deep at San Mateo, Calif., are made of two rings of galvanized, corrugated sheets of 18-gauge Armco iron, one above the other to form a wall of 4 ft. high. These form part of a "bio-filtration" plant. The effluent is pumped into a distribution system and used for washing the various parts of the plant and for irrigation around the grounds.[F44]

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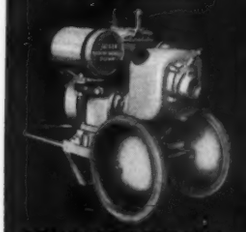
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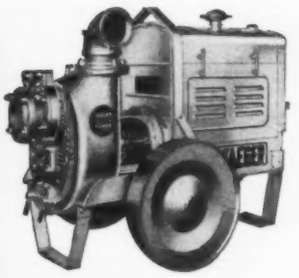
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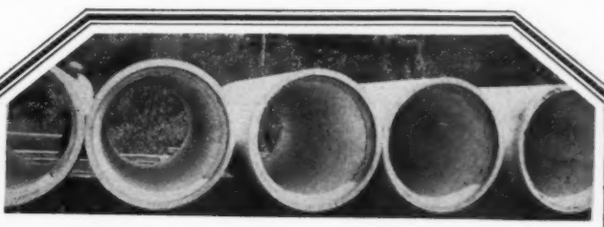
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Drum screens have been installed at Blackpool, England, for dry-weather flow described as an "entirely new type" which are very similar to the Weand screen used at Reading, Pa., about twenty years ago, except that the screenings are led from the inside of the drum through chutes, one at each end, instead of one chute. The drum is 18 ft. diameter and 7 ft. long; the screen openings are 3/8 in. square holes in a galvanized plate. Each screen is designed to deal with a maximum flow of 70 cu. ft. per second. Speed, one revolution in either one or two minutes.[D56]

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c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

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70. Operating the El Paso Chemical Treatment Plant. By C. D. Yaffe. Pp. 777-784.
71. Activated Carbon—Its Place in Sewage Treatment. By R. W. Haywood, Jr. Pp. 785-794.
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34. Flocculation Studies. By H. R. Green and J. C. McIntyre. Pp. 383-388.
35. The Tank Filter. By H. Bach. Pp. 389-393.

H *Municipal Sanitation*

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43. Hat Factory Waste Problem Solved at Danbury, Conn. By L. L. Bogert. Pp. 570-573.
44. Irrigation Water Reclaimed from Sewage. By H. N. Jenks. Pp. 574-576.
45. Operation of Intermittent Sand and Trickling Filters. By W. H. Wisely. Pp. 577-579.

American City

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10. *p.* Refuse Collection in Stratford, Ont. By W. H. Riele. Pp. 38, 40.
11. *p.* Refuse Collection Practices in Hamilton, Ont. By W. L. McFaul. P. 42.
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P *Public Works*

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51. Routine Sewer Cleaning Better than Emergency Cleaning. Pp. 19-20.
52. A Year's Operating Costs and Results of the St. Charles Sewage Treatment Plant. P. 24.
53. Work of the Ohio Division of Sanitary Engineering. P. 32.
54. *p.* Sewage and Refuse Disposal at Dover, Del. Pp. 44-45.

Road-Mix Sand Bituminous Surface Course

Methods of laying employed by the National Park Service

THE National Park Service has constructed a number of road-mix bituminous surfaces. Information is given herewith concerning the methods employed in building about 1¼ miles of this type of road near Kill Devil Hill National Monument, in North Carolina, as explained in the specifications for this project.

The exact quantity of bituminous material required lay between the limits of 3 and 6 gallons per square yard, depending on the character and grading of the aggregate material, the proportions varying within these limits as directed by the engineer after laboratory tests and field trials had been conducted. However, if, with the above quantities of bituminous material, the mixture was too lean, additional bituminous material could be required.

Other requirements are as follows:

The bituminous material can be either an asphalt cut-back or a tar; asphalt cut-back to conform to the requirements for material of designation RC-2, Specification SS-A-671, of the Federal Specifications Board; and tar to be homogeneous, be produced from gas-house, coke-oven, water-gas and/or similar tars, and conform to the following physical and chemical requirements:

1. Specific gravity at 25°C./25°C.	1.10-1.22
2. Specific viscosity at 50°C.	16-36
The specific viscosity range of the material as furnished shall be 16-26 or 26-36 as directed by the Engineer, depending on climatic conditions.	
3. Total distillate, per cent by weight:	
To 170°C. not more than	5
270°C. not more than	25
300°C. not more than	35
a. Softening point of residue, °C.	35-60
b. Specific gravity of total distillate at 38°C/38°C. mim. (water free)	0.96
4. Bitumen (soluble in carbon disulphide) min.	88.0
5. Water, per cent by weight, max.	2.0

The road material is required to be sand, or a mixture of sand and stone, gravel or shell in the proper proportion to furnish a dense mixture. Existing road material containing 10 percent or more of clay or other objectionable matter must (at the discretion of the engineer) be removed from the roadbed to sufficient depth and backfilled with satisfactory material, approved by the engineer before the application of bituminous material.

All equipment necessary for proper construction must be on the project, in first-class condition, and shall have been approved by the engineer, before construction will be permitted to begin. The equipment required is:

One pressure distributor—600 to 800 gallon capacity.
Trailer tanks, if necessary for proper application of bituminous material.
One grader, 12 foot blade with 12 inch rims, maximum weight 7,500 pounds.
One grader, 8 foot blade with 8 inch rims.
Three disc harrows—22 inch disc of an approved type for proper mixing.
One 3 furrow gang plow—14 inch bottoms, capable of plowing to a depth of 10 inches.
One 3 section spring tooth harrow with alfalfa teeth.
Two 50 tractors and three 25 tractors or equivalent.
One retread mixing machine of an approved type.
One 4 to 6 ton tandem roller with 4 to 6 cylinder motor.

Prior to applying the bituminous material, the road material is plowed to a depth of 10 inches and to a width of 2 feet outside of the proposed edge of the finished surface course. After plowing, the subgrade is dragged with a spring tooth harrow, and all roots and foreign matter removed as far as practicable. The road material is then machined with the grader having a 12-foot blade until uniformity of line and grade has been obtained.

After the existing road material has been cleaned and shaped, the bituminous material is applied uniformly by means of a mechanical pressure distributor equipped with spray bars capable of spraying the entire width of the proposed pavement.

The distributor while operating must maintain a pressure of not less than 20, nor more than 75 pounds per square inch. The temperature of the bituminous material at the time of application must not be less than 90 degrees F. No work is permitted when the existing road material is wet, or when the temperature is less than 60 degrees F. in the shade. Each application consists of 0.35 gallon per square yard or as directed by the engineer.

Mixing is done with disc harrow with 22-inch disc, 3-furrow gang plow and grader with 12-foot blade. After each application of bituminous material, continuous mixing with harrow follows. After approximately 2 gallons of bituminous material per square yard has been applied, the entire width of the pavement is plowed with the gang plow to obtain uniform depth, and mixing with harrows is continued. Material in place is then windrowed to a depth of 3 inches with the 12-foot blade, from center to outside of edges of pavement. After windrowing, application of bituminous material is continued the full width of the pavement, and also mixing with harrows and rolling from side to side with the 12-foot blade, until a homogeneous mixture of the required richness and depth has been obtained.

Material that has been windrowed outside of edges is then pulled in and spread with the 12-foot blade to a uniform surface. After the material has been spread it is plowed to obtain uniform depth.

After plowing, application of bituminous material is continued until a black glossy surface has been obtained.

In mixing the upper 3 inches, which is to be the wearing surface, harrows are used and during the last 3 or 4 applications of bituminous material, the mixing machine is used continuously, set to cut from 2½ to 3 inches. In conjunction with the mixing machine, a three-section spring tooth harrow is used to further perfect the mix.

After mixing has been completed the surface is dragged with the 12-foot blade to line, grade and cross section as shown on the plans for finished pavement.

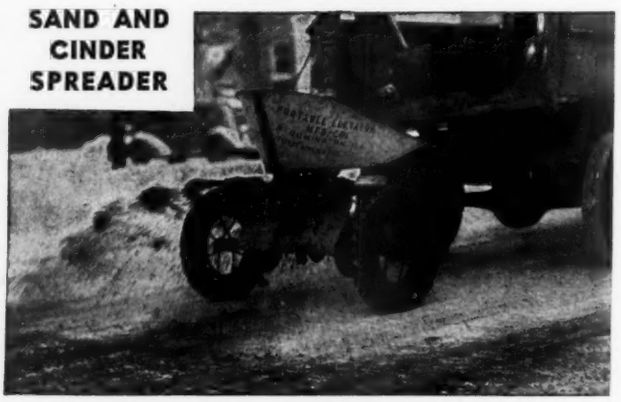
All irregularities in the surface at this time, as determined by the 10-foot straightedge, are corrected with properly mixed material while the pavement is soft. Dragging with the grader continues until directed by the engineer to discontinue.

After the surface course has set, it is rolled with a 4- to 6-ton tandem roller equipped with scrapers and

For BOTH Highways and City Streets

LITTLE GIANT

SAND AND CINDER SPREADER



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No special truck equipment is required with LITTLE GIANT—it can be hooked to any truck—changed in 1 minute. Has positive traction—rubber tires—needs no chains. Positive drive to spinners. Better agitation eliminates clogging and bridging of materials. Saves materials—spreads 2 to 3 times faster. Gives perfect distribution at any speed.

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Power Driven

GRAVELY SIDEWALK SNOW PLOW

Effectively clears paths 40-54" wide. Goes in places you wouldn't think of taking a big plow.

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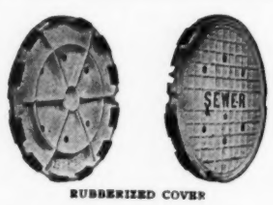
Gravely Motor Plow & Cultivator Co., Box 68, Dunbar, W. Va.



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oil sacks on the wheels to prevent picking up of the material. Rolling is done longitudinally, beginning at the edges and proceeding toward the center. After proper setting of the mixture, final rolling is done both longitudinally and diagonally until a uniform compaction and smoothness has been obtained, and all tractor and other marks are eliminated.

The surface is then tested again with a 10-foot straightedge laid parallel to the center line, and any variations greater than ¼ inch are corrected either by additional rolling or by removing the surface course and replacing with properly mixed mixture and compacting to a density and uniformity to conform to the surrounding area.

On construction in which tar is used, after final rolling and checking the surface for irregularity, and after the surface has thoroughly dried out, the finished surface is treated with 0.20 gallon per square yard of coal tar of the same quality as used in the mix, and covered lightly with sand to prevent picking up by traffic.

On construction in which asphalt RC-2 is used, a similar seal coat and cover, using asphalt RC-2 is, constructed if directed by the engineer.

During various stages of construction, test holes or trenches are dug in the mixture to determine the thickness. After the bituminous road-mix is completed, test holes or cross sectional trenches are dug at intervals of not more than 500 feet, or at closer intervals if necessary. The average thickness of surface course is determined from measurements made on these test holes or trenches.

When the surface course is more than ½ inch deficient in thickness, the area so deficient is reworked by scarifying, adding more bituminous material if necessary and remixing to a greater depth, so that after proper compaction the thickness will be equal to or greater than that shown on the plans.

After the surface course has been completed, traffic is not allowed upon it until it has set hard enough to eliminate rutting and cracking.

Highway Authorities' Right to Maintain Culverts

Highway authorities may, under the Iowa statute, maintain a culvert in a public highway to convey surface waters across the highway in the natural course of drainage, and an owner of adjacent property may not obstruct the flow of surface waters in their natural course, even though they have no well-defined banks. Such an owner, therefore, has no legal right to construct a dam on his land to widen the flow of water coming through a culvert constructed in the natural course of drainage to overcome its tendency to create ditches on the land, where the effect of the dam is to hold the water back on the highway so as to create a nuisance. The landowner cannot restrain a township from maintaining such a culvert, and the township may enjoin the landowner from maintaining the dam, the Iowa Supreme Court holds, in Township Trustees of Magnolia Township, Harrison County v. Drew, 249 N. W. 277.

Snow Melting De Luxe

After a snowstorm, there is only one place to go in New York—the warehouse of Houbigant, Inc., on West 45th Street. Instead of using ordinary rock salt to melt the snow on the sidewalk, Houbigant's janitor uses perfumed bath salts—rejected bath salts, he explains. The sidewalks smell wonderful.—*The New Yorker.*

Courtesy International Salt Co.

Chemically treated sand is being spread on this icy street to make it safe and to facilitate removal of the ice.

Winter Highway Safety by Ice Control

WHEN ice forms on highways and streets, travel is unsafe. Automobiles cannot be started, steered or stopped with any assurance. Curves and hills present the worst hazard, but even straight and level stretches of road are difficult to traverse when covered with ice.

Cinders and sand are in general use for minimizing dangers from ice. Cinders are preferable, though coarse sand is more available and may be used. But in cold weather, when the ice is hard, the cinder or sand particles will not adhere to the ice; their presence helps, but does not render the surface skidproof. Moreover, wind may blow the abrasive material off the road surface, or the particles may become coated with ice or frozen snow and thus lose their value.

By adding calcium chloride or rock salt, the effectiveness is tremendously increased. These chemicals have the property of melting ice with which they come in contact. When mixed with the cinders and sand, a fine film of chemical is formed around the particles of grit. Then when this material is applied to the ice, the particles embed themselves in the ice surface forming a non-skid and safe surface.

The Highway Research Board has stated in a report that there are few cases where scaling of concrete pavements can be attributed to the use of such chemicals with abrasives, though the abrasives on the pavement surface, after the ice has melted, may cause damage through the grinding action under the wheels of vehicles. Many pavements on which such treated abrasives have been used for many years show no indications of scaling, and there have also been many cases of scaling due wholly to other causes, no chemicals having ever been used.

Due to the possible damage to pavement surfaces through the grinding action of the abrasives, the amount of cinder or sand applied should be as small as possible. The use of calcium chloride or rock salt permits effective ice control with 1½ to 2 pounds of treated abrasive per square yard.

Recommendations by the Maintenance Sub-Committee of the Highway Research Board for the use of calcium chloride in treating cinders and coarse sand are that 25 to 50 pounds of calcium chloride be applied per cubic yard of abrasive, in either flake form or in solution; and that at the time the abrasives are applied to the highway, a further treatment of 50 pounds per cubic yard of flake calcium chloride should be applied. The treated abrasive should be applied at the rate of 1½ to 2 pounds per square yard. Spreading by means of mechanical spreaders is preferable to hand spreading, as the application can be made much more uniformly. Also, much better control of the rate of spreading can be obtained, so that excessive amounts of abrasives are not applied. Calcium chloride can also be used for melting accumulations of ice and compacted snow, in which case the resulting slush should be removed promptly.

Specifications for the use of rock salt have been outlined by the International Salt Co. This company recommends that the abrasive should contain not less than 100 pounds of salt per cubic yard at the time of application. While placing the

stock pile, 50 pounds per cubic yard should be mixed with the abrasive, and 50 pounds per cubic yard additional should be added to the abrasive at the time of application to the icy surface. When the abrasive is stored in bins, the same procedure is followed. When in stock piles, a small additional amount of rock salt should be spread over the exposed surfaces of the pile.

CC size rock salt is commonly used; in this size, 98% passes a 4-mesh screen, and 90% is retained on an 8-mesh screen.

In cases of emergency, and when it is desired to melt accumulations of packed snow and ice, salt may be added without the addition of cinders or sand. In no cases should more salt be used than will dissolve in the water formed when the ice melts. Under average conditions, it is never advisable to use more than about half a pound of salt per square yard of icy surface at one treatment, unless the resulting slush is removed within a short time, which can be done by means of a grader, scraper or bulldozer, or sometimes by flushing with a hose. This method of treatment is of value mainly in cities where the abrasives would tend to clog the storm drains.

Applying the Abrasives

The quickest and most economical way of applying abrasives to slippery roads is by means of sand and cinder spreaders. As already stated, these apply the material more uniformly, and a less amount is required for effective control—15% to 40% less—than when spread by hand.

The "Little Giant" spreader handles any kind of abrasives, spreading these in desired widths from 8 to 25 feet. Power for operating the spreader is by traction from the wheels. It operates at speeds of 3 to 10 miles an hour, and can be adjusted to spread thick or thin. The load, of course, is carried in the truck; the hopper of the spreader is 36″ wide, 30″ long and 18″ deep, of copper-bearing steel. Wheels may be thrown out of gear for moving from job to job, or when it is not desired to spread.

The Hercules-Detwiler spreader employs a different principle, the apparatus being driven by its own air-cooled gasoline motor. The quantity of material is regulated by the truck speed and the tail gate opening, the motor merely providing the uniform desired speed of the spreading vanes; the width of spreads depends upon the speed of the spreader disc. Spread of material is 6 to 30 ft. as desired. There is also a fan spreader made by the same company which spreads 9 feet wide.

Preventing Drifting by Snow Fences

Any adequate campaign for keeping highways open in the winter involves drift prevention as well as plowing. In fact, it goes farther than the mere erection of snow fencing to prevent drifting; it includes maintenance to prevent drifting.

Grass, weeds and brush along either side of the highway contribute to the formation of drifts, which are formed by the lowering of the wind velocity, due to some obstruction, and the consequent depositing of the snow carried by the wind as its velocity is reduced.

Banks on either side of the highway, and stone and rail fences also cause drifting, but there is less that the engineer or superintendent can do about these. Banks cannot often be cut back far enough to eliminate drifting, though flattening of bank slopes and proper roadside improvement will minimize the amount of drifting from this cause.

Placing the Fence

The location of a snow fence is determined by observation and knowledge of local conditions, strength and direction of winds, data on previous drifting, etc. All spots subject to drifting should be protected; anything else is false economy. One impassable drift on a stretch of road closes it just as effectively as half a dozen drifts. It is better to protect some places that may not drift than it is to neglect only one that is likely to.

Enough fence should be used at each place to give protection. If a section that is too short is used, the snow may drift around the end, especially when the wind shifts, and block the road. In sections where sudden storms arise from directions other than the prevailing winds, both sides of the road should be protected by snow fence.

Fences are usually placed back from the road about 15 feet for each foot of height—that is, a 4-ft. fence will be set back about 60 ft. from the road. Where drifting is excessive, a double row of snow fence may be an economy, the two rows being placed parallel and far enough apart so that the drifts will not overlap—about 75 to 100 feet. Raising the fence 6 inches off the ground appears to give the best results for all conditions of use. An inclination reduces the length of the drift, but if this inclination is not over 30° with the wind, it helps to keep the bottom of the fence clear. The ratio of openings to picket width is normally about 50%.

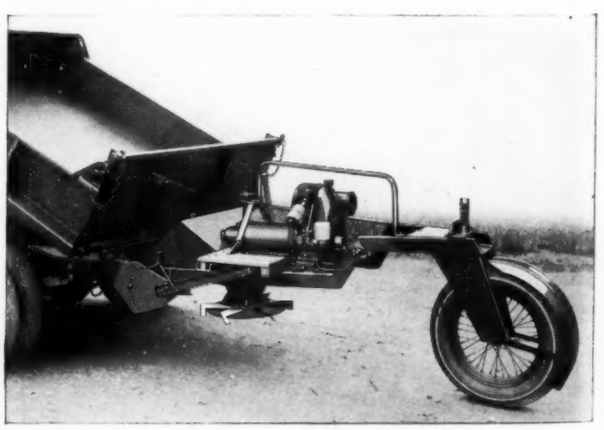
Types of Fence

A pressed sheet steel fencing is being made by Northfield that has had a wide use. "Metalvane" fence also is of metal. These are available in made-up sections that can be set up as needed very quickly, the sections being 12 ft. long and weighing but 70 pounds. This unit does not need posts, being fastened in place by a pin that can be driven into the ground, even when it is frozen. Several units can be joined together to make a fence as long as is needed or to extend fences found to be too short.

A snow fence is made by Beach of pine or spruce pickets, bound with 5 double cables of copper-bearing steel galvanized wire. The pickets are about 4 ft. long, 1½ inches wide and ½ inch thick. It comes in rolls 50 and 100 feet long, weighing about 3 pounds per lineal foot. Beach also furnishes "Y" steel posts, which give the necessary rigidity to support the fence. Standard posts are 6 ft. long and are provided with "snap-tite" fasteners which permit easy erection and taking down.

Mattson snow fence has pickets 4 ft. long and spaced 2 inches apart, bound with 5 galvanized iron cables. Pickets have square tops, which permit using the fence either end down.

The Gravely sidewalk plow—a mower in the summer—is a greatly appreciated tool in the winter.



Hercules-Detwiler Abrasives Spreader.

Snow Removal in New York City

By HILLIARD GOODMAN

NO city makes greater preparation for snow removal than New York City. With the greatest investment in streets and the heaviest traffic in the world, these arteries must be kept available, for the purpose for which they are intended, 365 days a year.

The burden of this tremendous task falls upon the Department of Sanitation. This department, which also flushes, sweeps and otherwise cleans the streets, removes ashes, garbage and rubbish, and keeps streets clear of debris and dead animals, is headed by Commissioner William F. Carey, Deputy Commissioner W. F. Powell, Superintendent of Snow Removal, John Donnelly, and Andrew Biagini, Assistant Engineer of the Bureau of Planning, upon whose shoulders falls the task of routing the snow removal program.

The snow-handling equipment is classified into two divisions: Division A consists of the departmental equipment that is ready for immediate snow work—flushers, crosswalk plows and brooms. As soon as snow begins to fall, this equipment goes into action. Division B, which is called out when there is an indication of a heavy storm, includes flushers, truck plows, snow loaders and sand spreaders. If more men and equipment are needed, they are borrowed from the borough presidents (the payroll being met by Sanitation Department funds), and if the storm is so severe as to require more trucks, they are hired from private firms.

Nature plays an important part in controlling the cost and man-power required. For instance, during the severe winter of 1935-36, when unusually heavy snows and ice were encountered, the cost to the department was $6,407,372.84. But in the much milder winter of 1936-37, the total cost dropped to $1,032,574; and the cost per cubic yard of snow removed from $0.362 for the preceding year to $0.144.

How, it may be asked, does the department obtain the required army of men as soon as a storm strikes? This year, the department has at its disposal a large force of WPA workers, who will be paid from departmental funds and will not lose any days from the quota they are granted on regular WPA projects. Other emergency workers are obtained through voluntary registration. Just prior to the winter season, trucks and other departmental equipment carry signs asking for volunteers, and that those who see the signs inform friends or relatives. Places of registration in each snow removal district are designated. Altogether, as many as 60,000 men have been employed to fight New York's worst snow storms.

Until last winter, the Sanitation Department had not made a sizeable purchase of more than one type of snow removal equipment for seven years. It still lacks adequate garage facilities, a factor that causes trucks and other motor equipment to depreciate more rapidly than it should. Below are listed the most important Sanitation Department purchases for snow removal in 1936-1937. In addition, there were purchased many other types of new equipment, chiefly for flushing and waste removal, but which can be used for loading snow and pushing snow plows if needed:

68	Joy loading machines	$ 473,280
42	"Snogo" machines	472,500
300	gas-driven dump trucks	1,590,000
308	gas-driven tractors with cross-walk snow plows	612,045
405	front-push type snow plows with lifting device	147,495
15	gas-driven dump trucks	85,095

In addition, 75 gas-driven flushers were bought at $464,175 and other dump trucks, largely for street cleaning purposes. The new equipment of the department is painted orange, to make it plainly visible, day and night.

Last winter's snow funds, realized by a special revenue bond issue of $1,070,000, were spent as follows:

Official Snow Depth, U. S. Weather Bureau, New York City

Personal Service	*Preparation*	*1.8" storm 11/23/36*	*4.2" storm 1/20/37*	*1.8" storm 2/5/37*	*1.5" storm 3/11/37*	*9.3 Total*	*App'priat'n $1,070,000*	*% of tot. Cost*
Dept. Sanitation	$94,848.14	$1,087.92	$137,798.07	$116,767.20	$38,078.99	$388,580.32		37.6
Other City Dept's	321.25		34,575.47	8,286.95	1,572.59	44,756.26		4.3
Emergency, Labor, etc.	1,809.00		145,418.01	109,094.00	14,983.54	271,304.55		26.3
Total	$96,978.00	$1,087.92	$317,791.55	$234,148.15	$54,635.12		$704,641.13	68.2
Other Than Personal Service								
Dept. Sanitation	$242,010.94		$64,772.25	$3,000.00	$2,000.00	$311,783.19		30.2
Other City Dept's	16,150.32					16,150.32		1.6
Total	$258,161.26		$64,772.25	$3,000.00	$2,000.00		$327,933.51	31.8
Sq. yd. area cleaned—229,430,805.45								
Cu. yd. snow removed—7,182,300.93						Total Cost	$1,032,574.64	100.0
Cost per cubic yard—$0.144						Surplus	$37,425.36	

Many times this expenditure was saved to the business of the city by maintaining the streets in such condition that traffic was not interfered with; and in addition there was a saving of life and property due to the safer condition of the streets.

The Department of Sanitation is becoming more self-sufficient with the passage of time. Last winter, the letting of contracts for snow removal was abolished. During the previous season (1935-36), private contracts had been let for approximately one-fifth of the total snow removal, for which the contractors were paid $1,659,896.21. Due to the fact that buses have largely replaced street cars in most of Manhattan and part of Queens, the street railways do not perform as large a proportion of the total snow removal as they did formerly, and the city now removes practically all the snow itself.

Figures showing the relative importance of the five boroughs in the snow removal program are given on the following page.

As an army has its divisions and regiments, this snow removal army has its combat divisions, further divided into route units. The principal divisions are the Snow Plow Organization, the Snow Fighting Organization, and the Snow Removal Force. The Snow Plow Organization, which is highly mechanized, operates

Relative Importance of the Five Boroughs in the Snow Removal Program

	Manhattan	*Bronx*	*Brooklyn*	*Queens*	*Richmond*	*Total All Boroughs*
Automotive equipment	—	—	—	—	—	6,265
Automotive flushers	785	131	528	239	100	1,783
Sanding machines	44	24	39	22	10	139
Flushing gangs	3,661	1,119	3,166	1,091	149	9,186
Hired trucks on snow	215	210	240	152	22	839
Hired trucks on refuse	127	168	394	98	1	788
Borough Presidents' equipment	20	128	185	237	51	621
Borough Presidents' laborers	967	794	267	1,594	399	4,310
Boro. Presidents' loading and dumping force	21	7	26	22	24	100
Emergency laborers	19,831	8,189	20,248	5,895	1,038	55,201
Emergency loading and dumping force	90	25	60	33	6	214
Emergency automotive equipment	1,019	531	833	846	190	3,419

brooms, flushers, cross-walk plows, and trucks, and loaders, over 720 routes. Several years ago, the installation of 400 hydraulic lifting devices on collection trucks made it possible to transfer 400 men to other duties.

The Snow Fighting Organization, composed of departmental employees and emergency snow laborers, works in conjunction with the Snow Plow Organization, cleaning cross-walks, nearside car and bus stops, and piles, sewers (shovels into sewer manholes) and loads snow while the storm is in progress.

The Snow Removal Force is composed of collection trucks—some of which are scheduled to operate with the Snow Plow Organization, being assigned to hauling after the plowing has been completed. Flushing machines, with plow blades attached, pile and sewer the snow. The force is also equipped with cross-walk plows and loading machines. In an operation known as "panning," departmental and emergency employees shove the sow into manholes. The territory south of 14th St., between the North and East Rivers of Manhattan (Snow Removal District No. 1), is cleared by a force known as the Snow Battalion, which augments departmental employees and emergency workers.

Methods of snow removal and of securing help and equipment are systematized, plans being made months in advance. Arrangements for collaboration with the borough presidents and the WPA are put under way in the fall.

Fitting the Snow Plow to the Job

When a town, city, county or State official in charge of snow fighting needs a plow—and they all do—the plow is, after all, only a means to an end. That end is a cleared highway. And the highway must be cleared under its own conditions as to road surfacings, snow depths, traffic conditions, the power units it will be used with and all the rest of it. A good plow in the wrong place is no better than a poor one.

The first step in intelligent plow buying, therefore, is for the purchaser to get clearly in his own mind what services and conditions the plow is wanted for, and then convey this information fully to the manufacturer. Some may have only two or three models to select from, but the larger manufacturers have more than is generally realized. There are, for instance, 175 different models of Sargent plows—enough, it would seem, to furnish the answer to any snow problem.

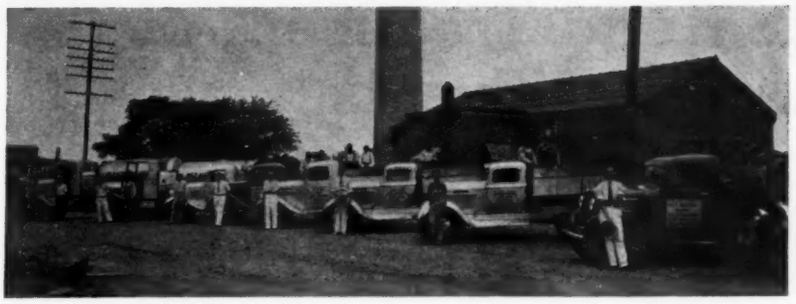
After all, says Mr. G. C. Soule, president of Maine Steel, Inc., what a purchaser really wants is not just a plow—he wants a certain service, performed with certainty under his most severe conditions. And he has a right to expect the manufacturer, on learning his needs, to fully appreciate just what they require and advise accordingly. Such appreciation can not be obtained by sitting in the office and reading about; it can come only from extensive field contacts. Mr. Soule and the engineers of his company have had years of such contacts, riding in the cabs while the plows were bucking the deepest drifts, or while hard-frozen snow and ice seemed to defy removal, so that when Supervisor John Jones of Cross Corners, and Street Superintendent Richard Roe of the big city, tell him in inadequate language what they are up against, he understands just what they mean, and can prescribe the remedy from his own past experience.

But this idea of service is carried a step—a big step—further. Having purchased a good tool, the purchaser must be encouraged to use it properly; and winter can put up some jobs that no plow, even the best and with the most intelligent use, can handle without getting into some trouble occasionally. In the estimation of this company, servicing plows is as important as selling them, and plenty of service trucks at strategic points should be kept in the field during the snow season, manned by service men, trained to help out any plow crew in trouble. There is a double advantage in this, for the experience acquired by these service crews one winter is used in designing improvements for the next. And, using the entire snow belt as a laboratory, it has been possible every year to improve upon the past. With a pioneering background beginning in 1919, Mr. Soule says that he finds his company always crowding close to an "advancing frontier"; for in a progressive industry like plow manufacturing, last year's best is the starting point for next year's standard equipment.

And real improvements are being made—not just talking points. And a purchaser who does not learn of the latest of these may be losing an opportunity to get more service for his dollar than he realized to be possible.

Materialman's Claim on Impounded Funds

Where a surety company, on default of the contractor for construction of a bridge, elected to complete the contract and demanded and received the benefits thereof, including the installments earned by the contractor and impounded by the filing of a materialman's claim with the State Highway Department, the Texas Court of Appeals held, McClintic-Marshall Corp. v. Maryland Cas. Co., 100 S. W. (2d.) 438, that the surety thereby assumed the burden of the contract, including the obligation to pay the materialman's account previously incurred by the contractor for labor and material used in building the bridges. The materialman was therefore entitled to have his claim paid out of the impounded funds. It was also held that the surety could not thereafter buy up claims against the contractor for payment of which it was liable and by filing them share ratably with other creditors, whose claims it was obligated to pay, in the distribution of the impounded funds.



Municipal vehicles with signs attached

Municipal Peripatetic Publicity

BUSINESS houses use the sides of their trucks and delivery cars for advertising purposes and they consider it mighty good advertising, so why shouldn't the city do the same. This idea actuated the city of Jackson, Miss., in providing attractive signs for its garbage and street cleaning trucks. These signs are changed often and are designed in a way to "sell the city to the city," not to mention the messages daily conveyed to visitors to the city.

GARBAGE & TRASH REMOVED FROM 12,000 HOMES 3 TIMES EACH WEEK

CITY WATER WORKS PROVIDES FREE WATER TO CITY DEPTS. WITHOUT COST TO TAXPAYERS

ALL PAVED STREETS WASHED & CLEANED 1 TO 7 TIMES WEEKLY

HELP US KEEP CITY STREETS CLEAN

BUILDING BETTER STREETS ECONOMICALLY

IMPROVING CITY DRAINAGE FOR FLOOD CONTROL

JACKSON CITY WATER PURER THAN U. S. PUBLIC HEALTH STANDARDS

JACKSON'S WATER WORKS HAVE ALWAYS BEEN SELF SUSTAINING NO TAX HELP NEEDED

Some of the signs placed on Jackson's garbage and street cleaning trucks.

Metal signs, 24 by 20 inches and in attractive colors, are provided for the street cleaning trucks, and wooden or masonite signs, two by six feet for the garbage trucks. These signs are of such a nature that they can be switched back and forth between trucks, so that the same sign is not seen in the same neighborhood long at a time. In this way each truck always carries a message of interest to citizens.

The signs have to do with the various functions provided by the city and touch all departments. Specimens of these messages which greet citizens from the sides of the municipal rolling stock follow: "All paved streets washed and cleaned one to seven times daily"; "Per Citizen cost of health dept., one cent per month," and "Radio-equipped police cars patrol city day and night."

Essential information about the municipal operations is conveyed in this way more effectively perhaps than by any other method. Only a few persons ever read annual reports, but they can't help seeing the signs, and the message is such that it sticks in their minds.

In other ways the city of Jackson acts as its own Chamber of Commerce. A public relations man is employed and he prepares various articles for the newspapers on municipal housekeeping, on city parks and playgrounds, on schools, etc. Even paid advertisements are sometimes published in the newspapers to stress various municipal accomplishments.

This keeping the populace informed of progress made, probably helps explain why the present city commissioners are kept in office year after year. Mayor Walter A. Scott and Commissioners A. F. Hawkins and R. M. Taylor were recently reelected for another four year term. Mayor Scott has headed the city government for more than 20 years.

Questions and Answers

Preparing for Licensing Examination

I would like to have something to study to prepare for an examination as a licensed operator. Water and Sewer Superintendent from Arizona, and several others.

Ans. At present there is little material available, except that published in technical magazines, and such material is not organized, and rarely refers to the details of operation. Some State Departments of Health furnish instructional material. Within the next two or three months, one of the leading correspondence schools of the country will have available two excellent courses covering operation of both sewage treatment and water treatment plants. Public Works will soon begin the publication of a series of articles covering the operation of sewage treatment plants.

Advancement for Water Works Operators and Superintendents

What may water works operators and superintendents look forward to in regard to advancement outside of their own communities? Water Works Superintendent from Iowa.

Ans. We believe that it is the duty of the technical magazines serving the municipal field and of the water works associations to leave nothing undone to bring this about. Frankly, we believe that licensing of operators is one of the primary steps, and that this should be accompanied by provision of instructional material that will help the operator to increase his knowledge. We do not think that an engineering education is a prerequisite for a good operator. If he is willing to work hard in improving himself, lack of technical training should be no handicap. There should be material that will serve as an introduction to the common engineering texts, but at the present, there are very few, if any, texts that the operator can use. One of the editors of this magazine has spent much time over the past two years in co-operating with a leading correspondence school—the leading one, we believe—in the preparation of a text that will furnish all of the information necessary for passing state license tests. A number of well-known men in the water works field assisted in outlining this text, and in checking it. It should be available within the next two or three months.

With adequate facilities for instruction, and with a fair and reasonable licensing system, we believe that the next few years will see a decided progress toward the goal that our correspondent mentions. In our opinion it is most desirable that this opportunity should exist.

Classification and Treatment of Industrial Effluents

By DR. GLENN V. BROWN

Consultant of the Pennsylvania Manufacturers' Association

UNDER the new stream pollution law now in effect in Pennsylvania, down stream owners and users may bring suit. We think it best, therefore, to treat effluents to a degree where they will not cause trouble at the time of minimum flow in the stream into which they are discharged.

The ideal waste disposal plant would be one which would furnish byproducts worth more than treatment costs. A study may show this possible in some cases but it is hopeless to expect to treat many wastes in a manner to yield a profit to the manufacturer. Net losses may be lowered by creating a demand for some of the products of treatment.

Where possible, the admission of the industrial effluents to the municipal treatment plant is desirable. The effluent may be introduced into the system in the form in which it leaves the industrial plant or in some modified form. Some equitable arrangement should be reached whereby this could be done. Proper adjustment of costs could be reached, based upon the organic load as measured by the biochemical oxygen demand and the character and volume of the solid and liquid wastes sent to the plant. Such an arrangement would be a relief to the manufacturer and an advantage to the community which assumed the responsibility.

Pearse thinks the admission of trade wastes to sewage disposal plants should be considered from the angles of the maintenance and upkeep of the sewers, the effect on the plant operation and the effect on the loading capacity of the plant. This would exclude effluents with ingredients which would adhere to the walls of the system or form deposits on them, inflammable substances, steam or hot water, acids or other substances directly affecting the material of the sewers and those substances which might inhibit or otherwise adversely affect plant operations such as causing foaming, excessive sludge deposits, special noxious odors, etc. It is obvious small volumes of wastes would have less effect when discharged to plants handling relatively large volumes of domestic sewage.

It is high time some localities recognize industrial establishments as an integral part of the community in other ways than through collection of taxes. It is our opinion that, within reasonable limits, the local sewage disposal plants should be adjusted to meet local industrial demands, rather than follow standardized procedures regardless of demands for service by the local manufacturers.

Co-operative group treatment by local manufacturers may be possible in some localities. Often two or more

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Turn to pages 51-53 for descriptions of helpful booklets and catalogs.

harmful ingredients react to form a relatively harmless mixture. This mutual action is frequently seen where many different kinds of industrial effluents find their way to a sewage disposal plant. The total plant load is often less than that predicted by adding the loads of the individual effluents discharging to the plant. But unless the industries or their products are mutually interdependable it is possible that one or more plants participating in the cooperative plant might curtail or even cease operations to the disadvantage of the others.

Trade wastes vary widely in both composition and volumes. One of the best versed men in trade waste disposal recently stated that no two wastes had been found comparable even when taken from seemingly identical plants. A general flow sheet for the treatment of certain types of trade effluents was shown at a meeting of the American Institute of Chemical Engineers in 1931, but it was supplemented by the statement that, while it might satisfy conditions in many units of a plant, it was invariably found that chemical dosage, recovery, efficiency, precipitation and settling rates and character of clarified effluents varied within surprisingly wide limits.

Classification of industrial effluents varies with the viewpoint of the interested person. One classification considers them as follows: 1. Those of high organic content, similar to domestic sewage but stronger, subject to biological action. This would include distillery, starch, sugar, milk, brewery and similar wastes. 2. Those rich in organic matter but not so putrescible. In this class would fall wool washings, pulp and some classes of paper, dyeing, printing wastes, etc. 3. Organic substances not readily putrescible but poisonous —such as gas and ammonia liquors, tar and tar products. 4. Inorganic wastes, such as acid pickling liquors, soda and potash wastes, salt water from oil wells, etc. 5. Poisonous substances as arsenic salts, sulphuretted hydrogen and other toxic substances. Class 1 as discharged, or in diluted form, may be treated by land or subsurface irrigation, biological filtration anaerobic action, etc. In general they have a tendency to clog. Evaporation may be resorted to for some of them. Class 2 is subject to cracking and recovery, clay treatment, double precipitation or centrifuging, and chemical action. Class 3 in general follow the laws of chemical action. Class 4—chemical action and evaporation. Class 5—special methods, usually chemical.

Pearse suggests the following classification: 1. Wastes carrying sediment or suspended matter, (a) heavy mineral, as ashes, etc., (b) heavy organic as tarry materials and (c) putrescible organic matter. 2. Wastes carrying little or no sediment (a) highly putrescible organic and (b) chemicals (subdivided into oxygen consuming and bacteria inhibiting). 3. Wastes carrying both suspended and soluble matter. 4. Floating materials (a) volatile, (b) fats and oils, (c) light organic matter and (d) light matter floating as a result of chemical action or gassing.

Langbein classifies trade wastes as containing one or more of the following: minerals, acids, salts, toxic substances, oils, fats, alkalies, and organic compounds.

The results of biological treatment depend upon the strength and characteristics of the treated effluent. Frequently too little thought is given to selective types of bacteria, a principle known and used in some chemical industries for years. Certain minerals may have sterilizing or beneficial effects. In some cases it is advantageous to add food for certain bacteria to promote action as a whole. Aktieselskabet Dansk Gaerings Ind. have patents (true also of others) for successive stages of bacterial treatment. Anaerobic decomposition is

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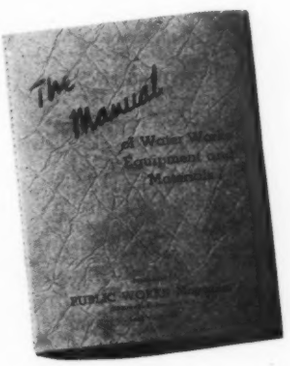

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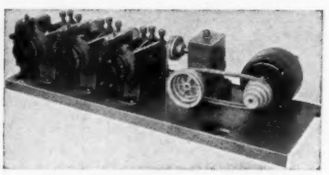
Small and medium size plants can use aqua ammonia and hypo-chlorine for chloramine treatment—both harmless solutions not requiring gas mask protection.

Also, aqua ammonia costs but one-half that of gaseous ammonia. For small and medium size plants so little chlorine is used that the higher cost of hypo is negligible when compared with relative costs (initial and upkeep) of apparatus used for feeding.



New Bulletin No. "Red" *Triplex Chemical Feeder*

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CONSULT US ON FILTRATION PLANT SPECIALTIES

We serve as skilled contractors to furnish and install the complete hydraulic and mechanical equipment in all forms of water treatment plants.

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promising for certain wastes but we question large scale efficiency.

There is considerable recent literature on taste and odor removal. Among proposed methods are storage and sand filtration or absorption, potassium permanganate treatment, activated carbon or similar substances, superchlorination or chloramine treatment, or combinations of any two or more of them.

The Swiss seem to be giving more attention to an attempt to increase the reacting surfaces, realizing that all chemical actions (with a few exceptions such as decompositions of the explosive type) are a matter of surface energetics. Germany appears to be losing the chlorine complex forced upon it by impoverished post-war conditions. Broad irrigation appears to be declining in England and the use of trickling filters is increasing for putrescible wastes; activated sludge is slowly progressing; filter presses are being used effectively, a matter which would bear study in the United States, though sanitary engineers in general do not appear to be very conversant with fundamental principles of filtration.

In general the unit processes involved in waste effluent treatment plants are those of mechanical separation (including screening, sedimentation, skimming and filtration), chemical precipitation or action, septic action, evaporation and various modifications or combinations of these designed to meet local demands and supplemented by special processes to meet specific demands.

We believe it would be to the advantage of manufacturers, especially those who are affected by the new law, to form a cooperative unit to act as a clearing house for information and assistance. A relatively small fee from the individual members would furnish sufficient funds to provide for the collection and classification of the literature on wastes disposal and treatment and a study of the markets to determine possible outlets for wastes and the treated products therefrom. The results of these studies, together with those on changes in the methods of waste treatment and innovations lowering operating costs would be made available to all members of the cooperative group.

(Extracts from an article in the Monthly Bulletin of the Pennsylvania Manufacturers' Association.)

City and Canning Factory Separately Discharging Wastes Could Not Be Sued Jointly

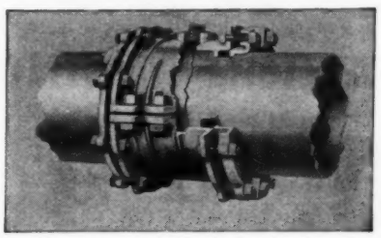
In an action by the owners of a farm against a city and a canning factory operating in the city for damages to the farm, it appeared that the effluent from the city's septic tank discharged into a creek and flowed upon the farm and waste matters from the factory also ultimately discharged into the same creek and onto the farm.

The odors arising from these separate acts, the Minnesota Supreme Court held (Johnson v. City of Fairmont, 247 N. W. 572) would, no doubt, constitute a nuisance upon the farm. But there was no concert of action between the defendants, no common intent to injure the plaintiffs. Their acts were separate as to time and place. The wrongs were not joint when committed and did not become joint because their consequences united and mingled on or near plaintiffs' farm. They could not therefore be held jointly liable for damages and an order granting the defendants' separate motions for judgment notwithstanding a verdict against them jointly was affirmed.

Keeping Up With New Equipment

Handling Winter Pipe Breaks

Water pipes have a bad habit of freezing when the temperature gets a little below 32° F, and usually when they freeze they crack; and then they always leak. The illustration herewith shows a



Cutaway view of Dresser repair sleeve.

quick-and-easy method of handling such breaks and leaks. It is a repair sleeve that goes around the pipe and bolts in place. End and side gaskets are blow-out-proof. This is just one of a large variety of such devices that are available. Information from S. R. Dresser Mfg. Co., Broadford, Pa.

Economical Snow Removal for Smaller Cities or Scattered Jobs

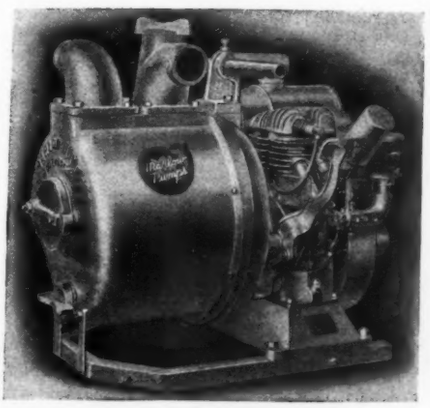
When snow is piled up in city streets, speed is necessary for removal; economy is also most desirable. For larger cities, the Barber-Greene 38-D loader has long been used, this unit being able to load about 10 cubic yards of snow a minute.

A junior model, the 558, has now been developed by Barber-Greene, which costs less, but nevertheless delivers 7 yards of snow a minute into trucks. This unit is especially designed for smaller cities and to augment standard equipment with less expensive machinery for scattered work, etc.

Both of these units are convertible into loaders for handling sand, gravel, broken stone and similar materials during the off-snow season. Both are described in an excellent booklet, "Low Cost Snow Removal," which will be sent on request to Barber-Greene, Co., Aurora, Ill. This is a 24-page booklet that contains much valuable information on snow-fighting and snow falls.

Aluminum Self-Priming Portable Centrifugal Pumps

Two new pumps have been announced by Marlow Pumps, Ridgewood, N. J., a 2-inch and a 3-inch. Both are light weight, self-priming centrifugals, complete with gasoline engines. The 2-inch unit will deliver 120 gpm; the 3-inch 180 gpm. Both are guaranteed for suction lifts of 25 ft. and a total head of about 50 ft. Both have both foot and rope starters, and also have just about



Marlow centrifugal pump.

Worthington Elbow-Propeller type pump has capacities of 1000 to 2000 gpm at heads up to 20 ft.

all standard automobile accessories, such as air cleaners, speed changers and automatic operation. And light in weight; the 2-inch weighs 98 pounds, the 3-inch 108, including starters. Pistol grip for one-man carrying; pipe grip for 2-man carry. Fuller information on request to Mr. Marlow.

Tractor-Loaders for Cleaning Roadside Ditches

Illinois, like other states, has the problem of cleaning out roadside drainage ditches. A number of methods were tried including the Allis-Chalmers Model "WM" tractor equipped with Hough hydraulic loaders; the results of tests with these have been so satisfactory that ten more units have been purchased.

With the new machines the operations take the following sequence: The tractor-loader unit is hitched to a conventional 8-ft. grader, which blades out the bottom

(Continued on page 47)

Barber-Green loader 38-D, above. At right, Allis-Chalmers tractor and Hough hydraulic loader.

Sewage and Water Plants Everywhere use

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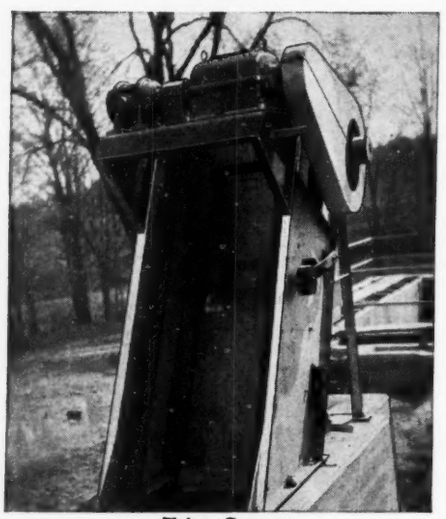

Tritor Screen

● Consulting and sanitary engineers and operators of sewage treatment and water purification plants have long known that Link-Belt bar screens, fine screens, sludge collectors, grit chamber equipment, scum breakers for digestion tanks, mixing equipment and driving machinery are durable, dependable, and economical, being built to last, and to operate at maximum efficiency. Send for catalogs.

Link-Belt Company, Philadelphia, Chicago, Indianapolis, Atlanta, San Francisco, Toronto, or any of our other offices located in principal cities.

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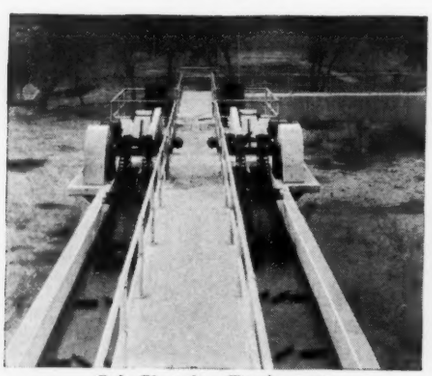
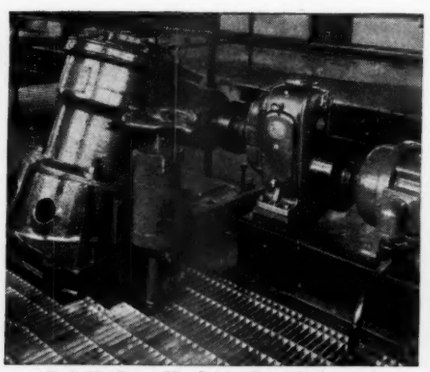
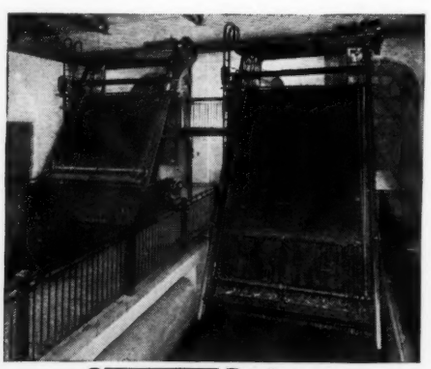


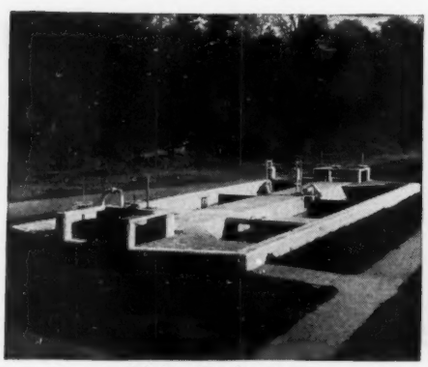
Grit Chamber Equipment



P. I. V. Gear Variable Speed Control



STRAIGHTLINE Bar Screens



Mixing Equipment

CIRCULINE Collectors

STRAIGHTLINE Collectors

Turn to pages 51-53 for descriptions of helpful booklets and catalogs.

Keeping Up With New Equipment

(Continued)

of the ditch leaving the debris on the shoulder. Back sloping the ditch is also done with the grader. When grading operations are completed the tractor-loader bunches the debris with a bull-dozer blade, and loads it into trucks at the rate of 40 to 50 cu. yds. per hour with the shovel loader. The change from bulldozer to shovel loader is made in less than ten minutes.

The bulldozing or back filling blade can be used on any operation applicable to the conventional bulldozer; that is, back filling, spreading, leveling, cleaning up, etc.

To facilitate transportation problems all machines are equipped with a transport buggy.

Compact Compressor

Davey Compressor Co., Kent, O., has brought out a "compact" air compressor with 105 cubic feet capacity. It is 62 inches high, 65 inches wide and 114 inches long. It has pneumatic tires and can be towed fast; one or two-stage. Highly portable.

Homelite 2-in. Centrifugal

Homelite Corp., Port Chester, N. Y., announces the addition of a new 2-in. portable centrifugal pump. Complete assembly weighs 86 lbs. including the built-in gasoline engine, and can be carried by one man. Capacity is 8,000 gal. per hr.; self-priming and will handle muddy water. The engine is air-cooled, with the pump impeller on its shaft; no floats, valves or stuffing boxes; pump is also available with electric motor drive.

FWD Maintainer

Among the features of this unit, which is designed especially for highway maintenance work, is the 23-inch clearance under the driving mechanism, so that an underbody scraper or other underbody maintenance equipment can be attached. Speeds up to 37 mph; 2-ton capacity; chassis weight (dry) 6,530 pounds; wheelbase 156 ins.; 5 speeds forward; four-wheel drive, of course; and full equipment. This is the Model HG, and fuller information is obtainable from Four Wheel Drive Auto Co., Clintonville, Wis.

The Davey "Compact" Compressor

Littleford Takes Over Wheeled Roller

The Wheeled Roller will be manufactured and sold exclusively by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, beginning January 1, 1938.

Originated and developed by the Wheeled Roller Corp., of San Antonio, Texas, the portability and practicality of this roller has won wide use among street and highway officials and contractors.

Since the introduction of the motorized Wheeled Roller, there has been a definite need for a geographically central point of manufacture to facilititate deliveries, and for national distribution of standard parts, along nation-wide sales and service arrangement.

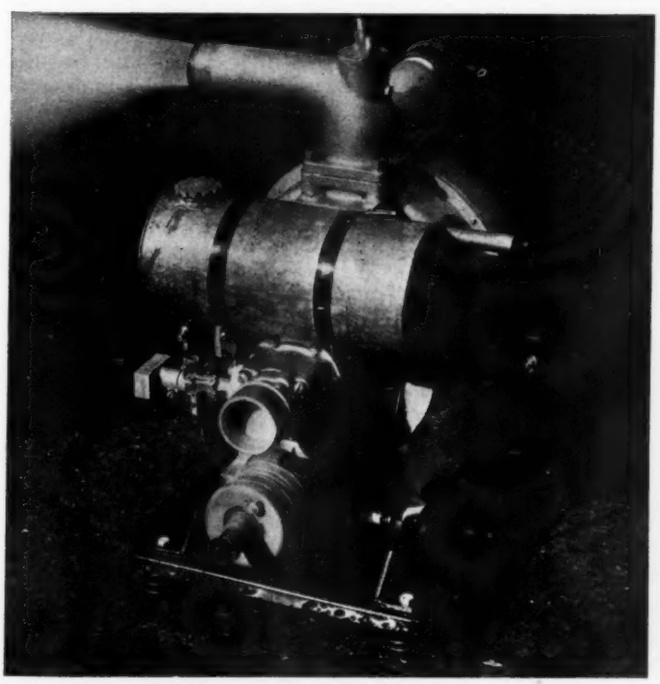
All these requisites are now provided by Littleford. The addition of this maintenance roller unit augments the Littleford line of Road Maintenance Equipment.

The unit will continue to be known as the Wheeled Roller. Important improvements in the mechanical design are being engineered by Littleford Bros., and will be brought out in their new models to be placed on the market January 1, 1938. Full details from Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio.

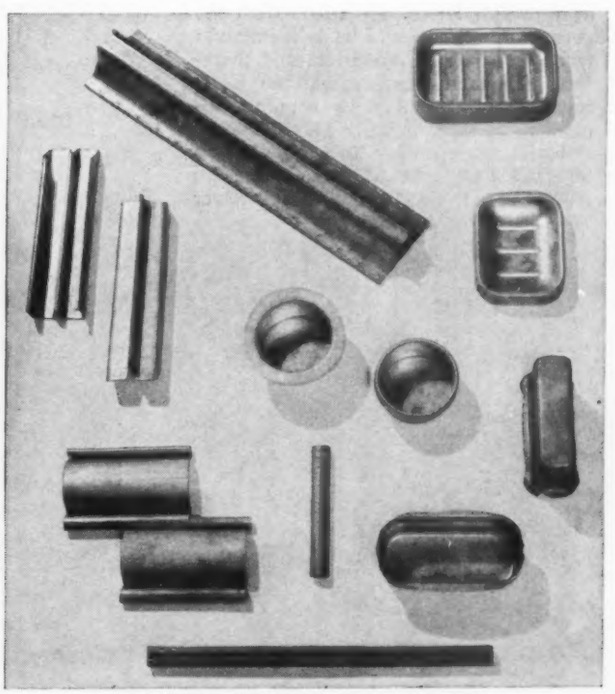
The FWD Maintainer

Zincgrip for Iron and Steel Coatings

A new method of coating iron and steel sheets with a heavy layer of commercially pure zinc that will not crack or peel has been announced by the American Rolling Mill Co., Middletown, O. These carry 50% to 75% more protective zinc than tight coat sheets generally used. There will be many uses for this new product in addition to that of coating Armco drainage pipe.



Homelite Centrifugal Pump



Armco "Zincgrip" coating applications

Keeping Up With New Equipment

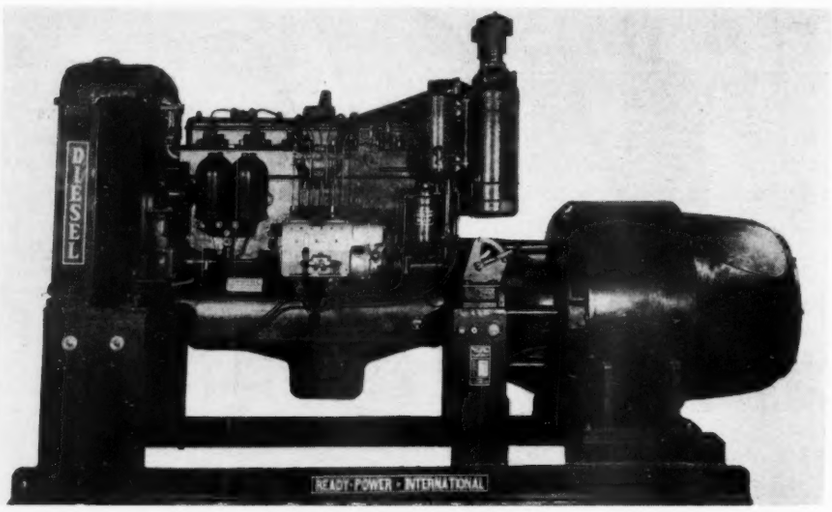
(Continued)

Ready-Power Electric Plants

These electric plants are unique in that the method of coupling the generator to the engine (always a weak link) has been designed to eliminate all the possible chance of trouble. Each generator is designed especially for the engine to which it is to be connected and bolts to and pilots into the flywheel housing.

The Diesel engine is the standard International heavy duty. It is simple to start, this being accomplished by opening a set of auxiliary valves, enabling it to start as an ordinary gasoline engine. After a preliminary warm-up period of about one minute, it is manually changed over to full Diesel operation. Both the generators and engines lends themselves readily to parallel operation, and therefore a demand of more than 60 KVA can easily be supplied by running two or more of these units in parallel.

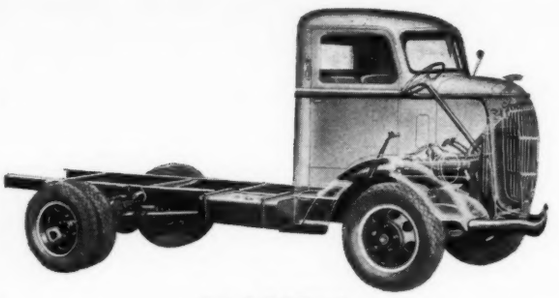
Units are available from 5 KVA to 60 KVA. Full technical information from Ready-Power Co., 3826 Grand River Ave., Detroit, Mich.



Ready Power Electric Plant

Reo C-O-E Trucks

The C-O-E means "cab-over-engine." One would hardly say that such an arrangement adds much to beauty, (though the new Reos shown herewith are pretty nice at that) but it does give better weight distribution, greater load-carrying space, shorter overall length and easier handling in traffic; also, Reo says, better appearance, accessibility, driver comfort and safety. Anyway, these new trucks are made in 2 capacity ranges—6 to 7½ tons gross—and four lengths of wheelbase, from 105-inch for close-coupled, to 166-inch. For other details, write Reo Motor Car Co., Lansing, Mich.



Reo C-O-E Truck

Steel Bridge Flooring

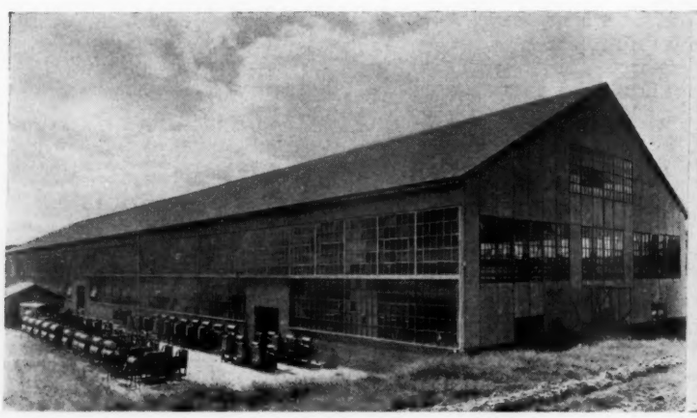
Carnegie-Illinois Steel Corp., Pittsburgh and Chicago, have brought out a new bridge flooring. It consists of 5-inch beams on 6-inch centers, with 1¼ x ¼ cross-bars intersecting at 3-inch intervals, with two additional supplementary cross-bars spaced equally between the main carrying beams. Openings in the floor are about 1.62 ins. by 2.75 ins. Can be applied directly to stringers; weighs above stringers 18.3 pounds per square foot; fabricated in standard width. Other advantages are listed by the makers. If you have a bridge floor problem, write to the above address.

Gasoline Driven Chain Saw

All you have to do is to "ride" this saw, and the man on the other end won't complain; he'll be joyriding, too. It saves the back, not to mention the 1001 other muscles that you discover when you start business with a cross-cut saw on a nice big log. You can pick this unit up, put it in a light truck, and when you get there "simply start the gasoline engine and begin cutting operations." Power through a flexible shaft; a saw runs around a track like the tread on a tractor. Guards keep fingers and toes away from places where they are likely to be shorn off. We suggest you write today to Mall Tool Co., 7745 South Chicago Ave., Chicago, Ill.

Bucyrus-Erie 1¼-yd. Convertible Shovel

The 33-B is a new Bucyrus-Erie shovel, which is convertible to dragline, clamshell, crane or dragshovel. As a shovel, it has 1¼-yd. capacity. It is available in gasoline, diesel or electric. Specifications from Bucyrus-Erie Co., South Milwaukee, Wis.

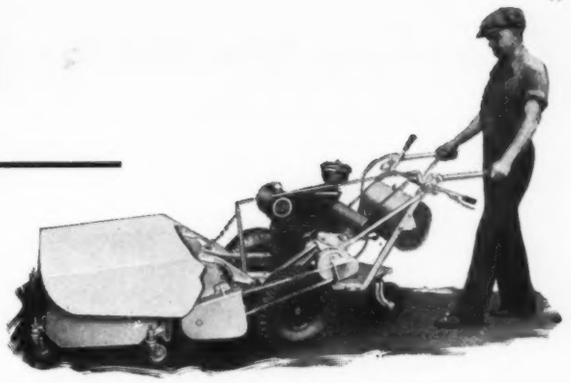


Additional space of 25,000 sq. ft. is provided for Schramm, Inc., West Chester, Pa., by this recently completed addition to the factory.

Armco's new modern, research laboratory at Middletown, O. provides an acre of floor space. All welded—not a rivet in it.

Keeping Up With New Equipment

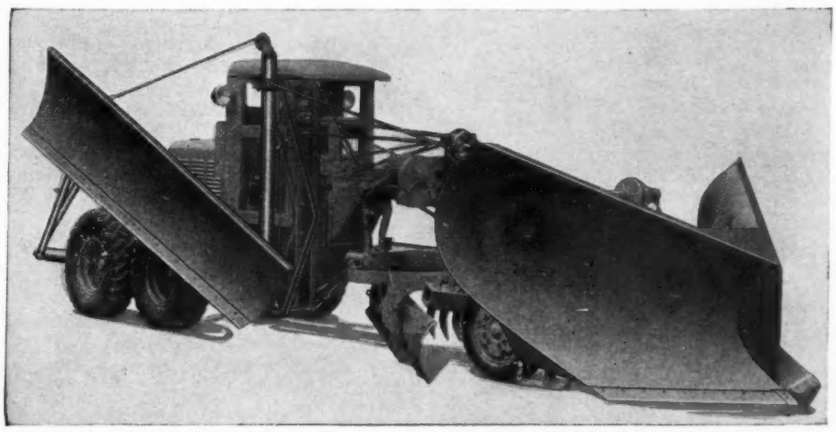
(*Continued*)



Right, the Ideal Sweeper. Below, the Adams Snow Plow and Wings.

Adams Snow Plow and Wings

A new snow plow and a new snow wing have just been announced by J. D. Adams Company of Indianapolis, Indiana. These units are intended for use on Adams Motor Graders Nos. 301, 151, 50 and 51 which use engines of 39, 57, 59 and 62 H.P. respectively. They are shown here mounted on the No. 51 which is powered by 62 H.P. Diesel engine.



This is a stream-line model; the plow is 3 ft. 6 in. high in front and 6 ft. high at the rear. The curvature lifts the snow as much as 5 ft. which means that it is actually lifted up and thrown out over the top of the surrounding snow even though the snow is quite deep.

The wing slopes the snow banks and simplifies widening operations. It is 12 ft. long and flares from 31 to 36½ in. wide, is independently adjustable for height at both ends. It may be set horizontally to move light snows outward as much as 10 ft. or it may be angled at a height to deliver snow on top of a 10 ft. bank. Both plow and wing are power-controlled, utilizing the regular power outlets furnished with each grader. Full description on request.

Modern Refuse Carrier

The Bureau of Street Cleaning of the Department of Public Affairs in Newark, New Jersey, uses this new model CJ Mack truck as a helpful addition to the equipment already in service for the Bureau of Street Cleaning.

Having a body of 16.6 cubic yard capacity, this truck is well fitted for removing refuse. There are two doors on either side of the body, one above the other, so that when the lower part of the body is filled up, the lower door may be closed and the upper door opened for loading more into the body. Also at the rear are two large doors. A special feature is the lengthening of the frame in front for the mounting of a snowplow in winter.

Below, a Model Refuse Carrier

For Easy Sweeping of Large Areas

Here is a power sweeper that has a lot of uses. It will sweep floors of all kinds, sidewalks, roads, etc. We believe it would work well on street patching and resurfacing, where small jobs only are involved. Can be furnished with or without dust-box. Steers like a plow; mounted on balloon tires, 15x4½; has sprinkling tank of 5 gallons capacity; straight or angle brush. 2 hp. engine. Full information from Ideal Power Lawn Mower Co., Lansing, Mich.

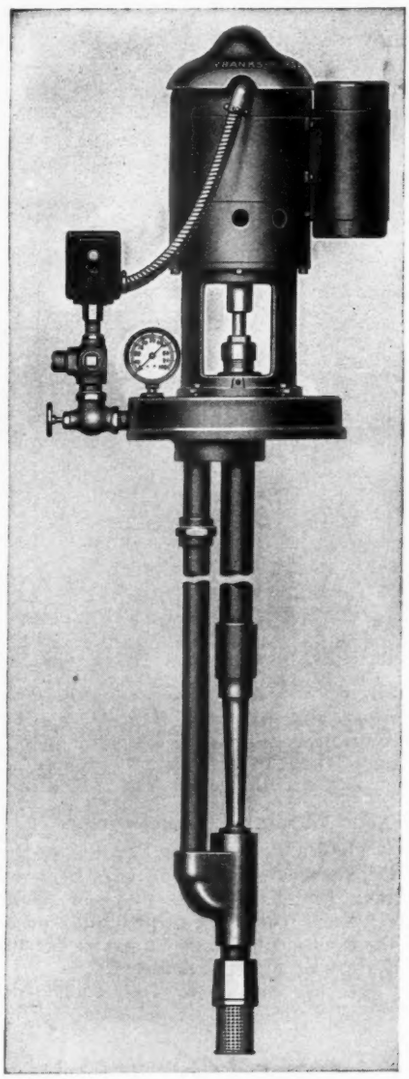
Rubber Tracks for Tractors

A rubber endless track for tractors is said to increase the tractive power of tractors, and permits the tractor to be used on any surface, from concrete to soft earth; power and fuel savings; speeds up to 60 miles an hour. Bill Upson will have a whole new set of topics for tractor stories. This track has been developed by the B. F. Goodrich Co. Data on request to us or them.

Keeping Up With The News

F-M Pump for Deep or Shallow Wells

A pump designed to give economical and dependable results for small diameter, low-capacity wells has been announced by Fairbanks, Morse & Co., Chicago, Ill. It works well under high or low pressures, at 6 to 60 gpm. Units for lifts of 15 to 20 feet consist of a combined motor, pump and base, into the bottom of which is screwed a single suction pipe. For deep wells, 20 to 200 ft., pumps are equipped with an ejector and venturi, operating on the accepted principle of the centrifugal pump with the ejector added to lift water from greater depths. The venturi allows a predetermined amount of water to bypass down one of the drop pipes, creating a vacuum and drawing well water into the suction chamber.



F-M Deep or Shallow Well Pump

A Neon Flashing Beacon Signal

The Lewis Manufacturing Company, of Decatur, Ill., has developed a new type, battery-operated neon flashing beacon signal. The use of a neon bulb gives a ray which has penetrating power in fog, mist, rain, snow, or other adverse weather conditions.

This bulb is operated on a nine-volt dry battery, through means of a new type "flasher control." So effective is this flasher control that one battery will operate the neon bulb on a frequency of eighty to two hundred times a minute, 24 hours a day, for a period of four to six months.

Neon flashing beacon signal with batteries set in the base.

Streamlined Trucks

There are twelve new Federal trucks which have "dynamic streamlining." We don't know what that means, but the pictures we have show a good looking truck; you could pretty near get by with one of these for a Sunday ride with your girl. These new models range from ¾-ton to 5-ton capacity. They have 2-tone color combinations, contrasting shades on the instrument panel, and so many other "effects" that the old truck-wreckers that were extant when yours truly broke into highway construction wouldn't know they were in a truck. A chrome medallion is the identifying emblem on these new models and if you know what a chrome medallion is you can identify one of the new Federals without trouble when you see one. But seriously, the technical specifications buried in blurbs of the publicity we got make us feel that these new trucks will haul rock and hot stuff and stand up to the hard knocks of construction work. If you want the dope on these trucks, write Federal Motor Truck Co., Detroit, Mich.

National Paving Brick Association

The thirty-second annual meeting of the National Paving Brick Association will be held at Cincinnati, Ohio, January 12, 13 and 14, 1938, at the Netherland Plaza Hotel. In addition to the business meetings many of the sessions will be open to the general public. Those interested in street and highway development are cordially invited to attend.

The program will include papers and discussions by prominent engineers and contractors experienced in the use of brick for paving purposes. Important recent developments in manufacturing, in the technique of testing and in construction practices will be considered. There will be descriptions of modern brick projects, such as the recent paving of the new Lincoln tunnel under the Hudson river in New York City. The Research Bureau, maintained by the National Paving Brick Association at the Ohio State University Experiment Station, will report on its year's activities including both laboratory and service investigations and studies. Increased skid-resistant properties for brick pavements as a result of the development of non-exuding filler materials and other important accomplishments of research will be discussed.

The relationship of the brick type of pavement to the highway problem of the present and future will be an important theme of the convention. This will involve the contribution that brick can make to highway safety; and its adaptability as a heavy duty type.

C. C. Blair, head of the Metropolitan Paving Brick Company of Canton, Ohio, is President and George F. Schlesinger is Chief Engineer and Secretary of the National Paving Brick Association.

News of Personnel:

Ralph M. Shaw, Jr., has resigned, effective January 1, 1938, as manager of the advertising and publicity department of the United States Pipe and Foundry Company, Burlington, N. J. Mr. Shaw will open his own offices in Philadelphia as manufacturers agent representing a number of manufacturers of industrial power equipment.

A. Elliott Kimberly, after four years of service with the Ohio Public Works Administration, is resuming private practice as consulting sanitary engineer with offices at 20 South Third St., Columbus, O.

Milo S. Ketchum, Jr., has been appointed assistant professor of structural engineering at Case School of Applied Science, Cleveland, O. He is the son of the late Milo S. Ketchum, dean of the College of Engineering at the University of Illinois, and author of many textbooks.

Kenneth Markwell, state director of PWA for Tennessee, has been appointed chief project engineer for 22 PWA power projects in the Tennessee Valley area. Mr. Markwell will be assisted by Rufe Bearden Newman, Jr., Carl L. Gerhardt, Worth Crowley and Ward D. Carpenter.

Readers' Service Department

These booklets are FREE to readers of PUBLIC WORKS.

CONTINUED FROM PAGE 52

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1¼ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Large Cast Iron

408. Handy cast iron pipe and fittings catalog contains A.W.W.A. and A.G.I. standard specifications for a wide variety of cast iron pipe specialties, both bell and spigot and flanged; also dimensions Lynchburg Foundry Co., Lynchburg, Va.

Pipe, Steel

409. A very complete, 60 page, illustrated bulletin on spiral welded pipe including lots of useful engineering information, hydraulic data, flow charts, specifications, etc., issued by American Rolling Mill Co., Pipe Sales Div., 1101 Curtis St., Middletown, Ohio.

Pipe Forms

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

413. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

414. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

Taste and Odor Control

417. How, when, and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

422. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

424. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Run-off and Stream-Flow

425. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

428. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straight-line Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Snow Fighting

Plows

349. "V Type Sno-Plows for Every Size Motor Truck" describes and illustrates all features of the Frink V type plow, including the new power hydraulic control as well as the earlier types of lifting devices. Also describes and illustrates 14 styles of leveling wings and the different attachments which may be used in connection with them. Just issued by Carl H. Frink, Mfr., Clayton, N. Y.

350. One-Way Speed Sno-Plows are illustrated and described in a 4-page catalog. Features, specifications, methods of attaching. Carl H. Frink, Clayton, N. Y.

352. Snow Plows for 1¼ to 2-ton Trucks, Bulletin 1698; snow plows for 3-ton trucks, Bulletin 1699. Cover straight-blade reversibles, one-way and V plows. Controls; specifications. Austin-Western Road Machinery Co., Aurora, Ill.

362. The Sargent Handbook for 1938 contains sound, practical and valuable information on how to plow snow, and the types of plows, wings, etc., best suited for the various conditions of work. 86 pages. Sent on request. Maine Steel, Inc., South Portland, Maine.

357. Hydraulic Controls provide "fingertouch" ease in handling snow plows, and are simpler, quicker and permit higher operating speeds. For information on installation on present plows, ask for Bulletins 36-12 and 36-13. Vickers, Inc., 1412 Oakman Blvd., Detroit, Mich.

359. "Avoid Winter Tie-Ups." A folder describes various types of thawing equipment and their uses. Hauck Mfg. Co., 124-136 Tenth St., Brooklyn, N. Y.

Salt

355. "Make Icy Pavements Safe With Rock Salt" is an authoritative booklet describing one of the most effective and economical methods of winter ice control. International Salt Co., Scranton, Pa.

Tractors

361. "New Snow Power." A booklet describes Case heavy-duty, four-speed special wheel tractors for snow removal work, grading, ditch cleaning, shoulder shaping and medium construction. J. I. Case Co., Racine, Wisc.

363. The Linn tractor, a combination motor truck and crawler tractor is described and its many uses for snow fighting, road maintenance and construction outlined in a folder. Linn Mfg. Co., Morris, N. Y.

Spreaders: Sand, Salt, etc.

365. New bulletin gives full details and illustrates Hercules Spreaders for quickly spreading sand, salt, cinders, chloride. Hercules Products Co., Galion, Ohio.

366. Flier shows pictures of Little Giant Sand Spreader in action and gives complete details. Illustrates method of spreading sand, cinders, salt, etc., quickly and evenly. Portable Elevator Mfg. Co., Bloomington, Ill.

Setting and Testing Equipment for Water Meters

430. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

432. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

Screens

435. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Incineration

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 214 West Huron St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

453. How to avoid sludge and scum troubles in settling tanks explained in detail in Book No. 1542—has excellent drawings and photographs, also specifications. Most important are the carefully prepared capacity tables. Link-Belt Co., 307 N. Michigan Ave., Chicago, Illinois.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 570 Lexington Ave., New York, N. Y.

Water Works Operating Practices

490. This is a reprint of two excellent papers by F. E. Stuart. One outlines a number of filtration and field practices of value. The other presents a lot of kinks the author has picked up in visits to more than 1,000 water works plants. Sent free by Activated Alum Corp., Curtis Bay, Baltimore, Md.

Drawing Supplies

495. Perspective and Isometric paper, graph paper, tracing paper, blue print hangers, automatic (irregular) curves, adjustable curves, multi-purpose charting papers, etc. Write for illustrated bulletin. Wade Instrument Co., 2246-PW, Brooklyn Station, Cleveland, Ohio.

For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

Road Bed Drainage:

H. E. Cotton, drainage engineer for Armco, wrote a lengthy and excellent treatise on the precise and detail methods of highway subdrainage, including use of soil auger, location and depth of subdrains, cut slopes, installation of pipe, etc. This was published in the Highway Magazine, and is now available as a reprint, along with a preliminary discusson by H. H. Houk. 20 pages. Sent on request to Armco Culvert Mfrs. Assn., Middletown, O.

Cold Weather Concreting:

Minimizing Winter Costs and Winter Job Practice are the two subjects covered in this excellent 16-page publication. It tells in detail what happens when cold weather comes, gives tabular data on the effect of temperatures on the compressive strength of concrete, details a method of cost comparison for protection. Sent on request to Incor Division, Lone Star Cement Corp., 342 Madison Ave., N. Y.

Cold Weather Lubrication:

Pretty good information on cold weather lubrication of construction machinery appears in "Lubrication," which is published by the Texas Co., 135 East 42nd St., N. Y. Ask for October, 1937, issue, which will be sent on request.

Getting More from Motor Trucks:

This booklet, "10 Ways of Getting More Work out of Motor Trucks," is intended primarily to sell a recording unit, but it contains a lot of information on how to manage your trucks to cut out a lot of waste time and money. Write for copy to Service Recorder Co., 1422 Euclid Ave., Cleveland, Ohio.

Stabilization:

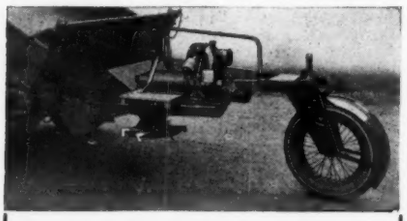
Bulletin 25, 1937 Edition, Low Cost Roads Stabilized with Binder Soil, Aggregates and Calcium Chloride contains: Principles; mixture designs and computations of quantities, construction data on road and plant mixing, drainage, etc.; information on maintenance, standard specifications and other practical detail information. 85 pages. Sent on request to Calcium Chloride Assn., Penobscot Building, Detroit, Mich.

Armco Sewers:

A remarkably fine 48-page text describing the use of Armco corrugated pipe for sewer construction. Gives specifications; also capacity and flow charts; comparative costs; design factors; durability and service records; fittings, installation data; and much other information. Excellently prepared and illustrated. Sent on request. Armco Culvert Mfrs. Assn., Middletown, Ohio.

Binders and Aggregates:

The Role of Soil Binders and Aggregates in Soil Stabilization is the title of a publication by C. A. Hogentogler and James A. Kelly of the Bureau of Public Roads. This is published by the ARBA in a 43-page booklet, along with two other papers: Road Stabilization by L. L. Allen, and Stabilization with Aggregates, Binder-Soil and Calcium Chloride by Fred Burggraf. It will be sent on request to Calcium Chloride Assn., Penobscot Bldg., Detroit, Mich.



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Fastest foe of ice and snow! Spreads sand, salt, cinders, chloride.
Save 15 to 20%
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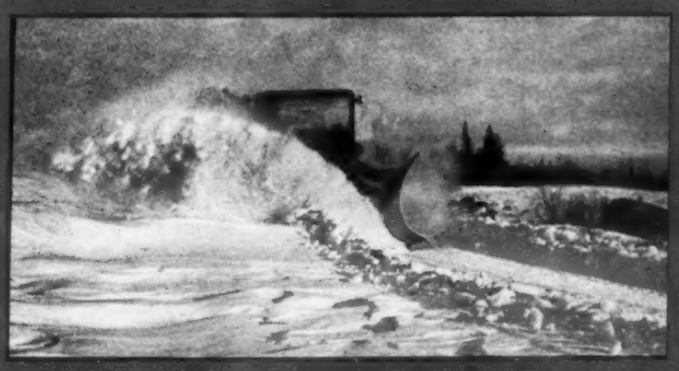
PUBLIC WORKS

The **SARGENT**

One hundred and seventy-five Models for Trucks and Tractors

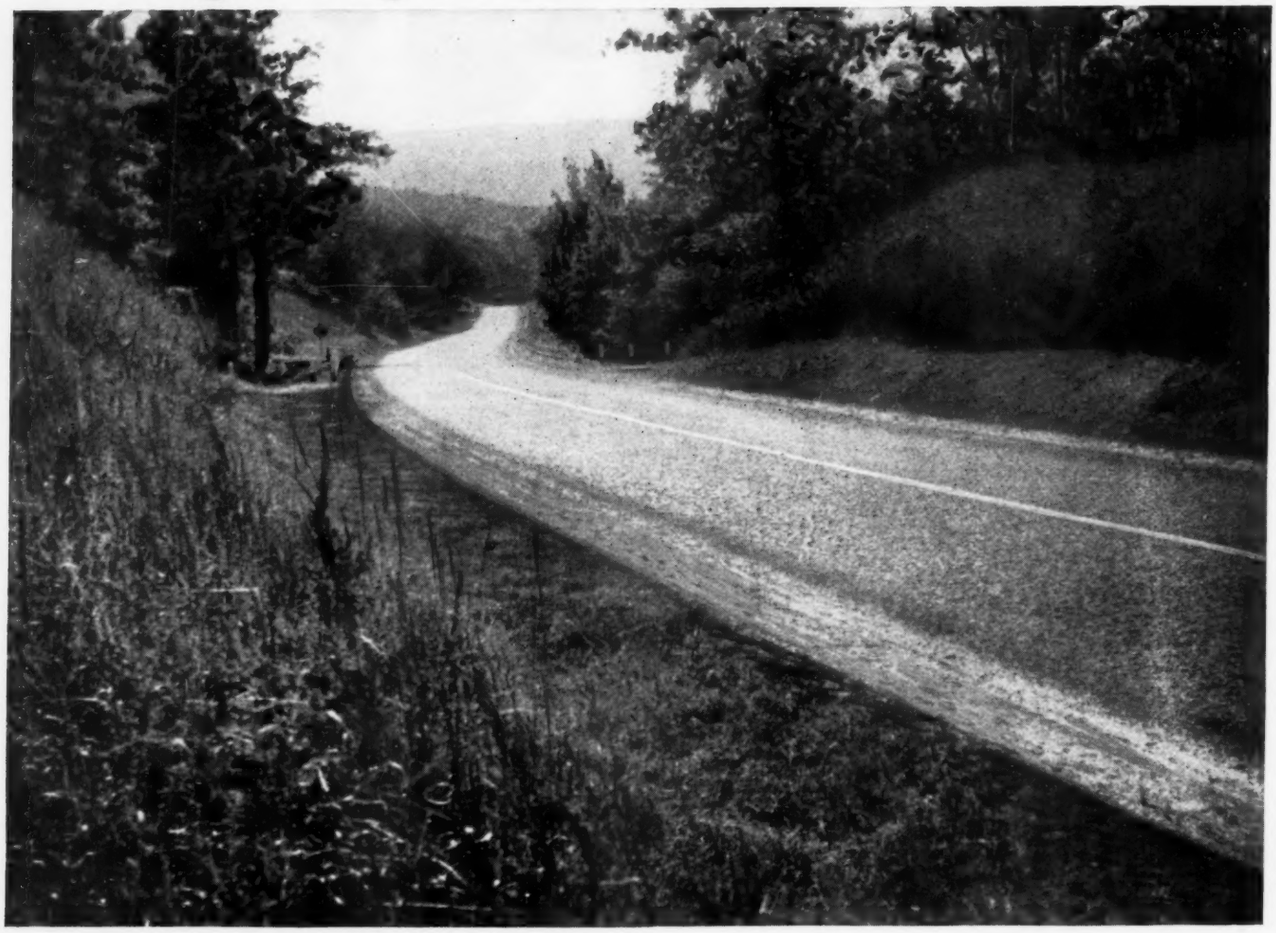
The Sargent Engineers and the Management of the Company wish a Merry Christmas and a Happy and Prosperous New Year to the thousands of loyal friends whose continued support and constructive thought over nearly two decades have made better snow plows possible.



MAINE STEEL, INC. South Portland, Maine

DECEMBER, 1937

Good Engineering and Good Products Make Good Roads



Socony Binder C, Bituminous Macadam, Standard Brand, on Route 202, Massachusetts.

Socony Asphalt Road Oils • Socony Asphalt Joint Fillers • Socony Waterproofing Asphalt • Socony Cut-Back Surfacing Asphalt • Socony Asphalt Binder A for surface treatment • Socony Refined Asphalt for sheet asphalt paving • Socony Cold Patch Asphalt for all types of patching • Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) • Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) • *Specifications and all other particulars furnished on request.*

STANDARD BRAND
SOCONY ASPHALTS AND ROAD OILS

SOCONY-VACUUM OIL CO.

INCORPORATED

STANDARD OIL OF NEW YORK DIVISION

VOL. 68 PUBLIC WORKS No. 12

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DECEMBER, 1937

5-STORY DORMITORY IN L. S. U. STADIUM

'INCOR' SAVED $9400 ON FORM LUMBER ALONE

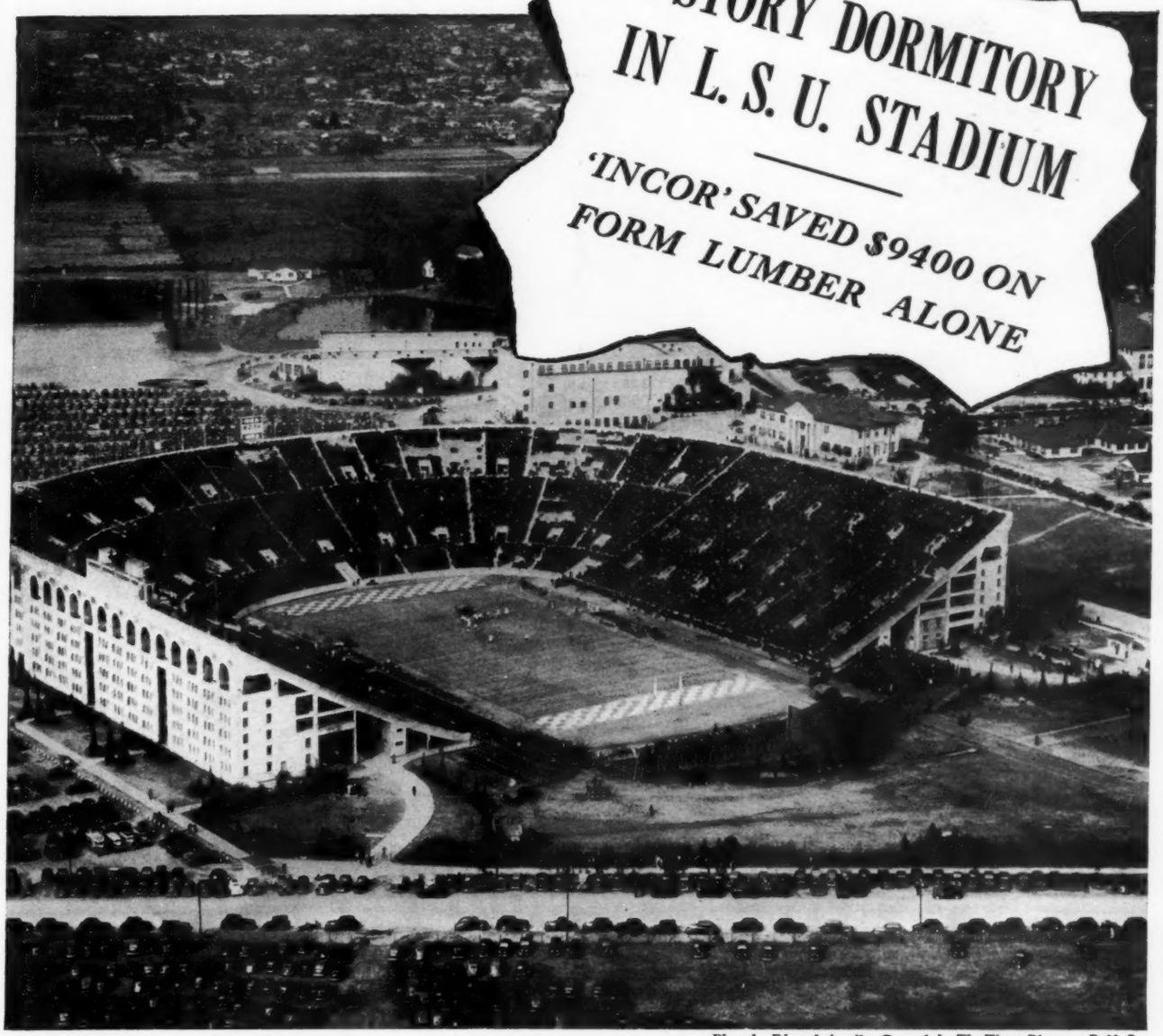

Photo by Edward Agnelly. © 1936, by The Times-Picayune Publ. Co.

LOUISIANA again makes construction history—by erecting a dormitory in a football stadium. At Baton Rouge, this new L.S.U. concrete 'horseshoe' provides seating space for 46,000 persons at sporting events, while 499 dormitory rooms under the structure house 1,000 men students, bringing $11,976 revenue to the University each month of the school year.

Designed by Weiss, Dreyfous & Seiferth, architects, New Orleans, and erected with W.P.A. labor, under supervision of George A. Caldwell, of L.S.U., work of completing the stadium started May 11, 1936. 'Incor' 24-Hour Cement was used for all grandstand concrete. Result:

Stadium was dedicated Thanksgiving Day. 'Incor' made it possible to open the stadium more than a month earlier. And Mr. Caldwell estimates saving in form lumber alone at $9400. One month saved on job overhead also meant real money, too.

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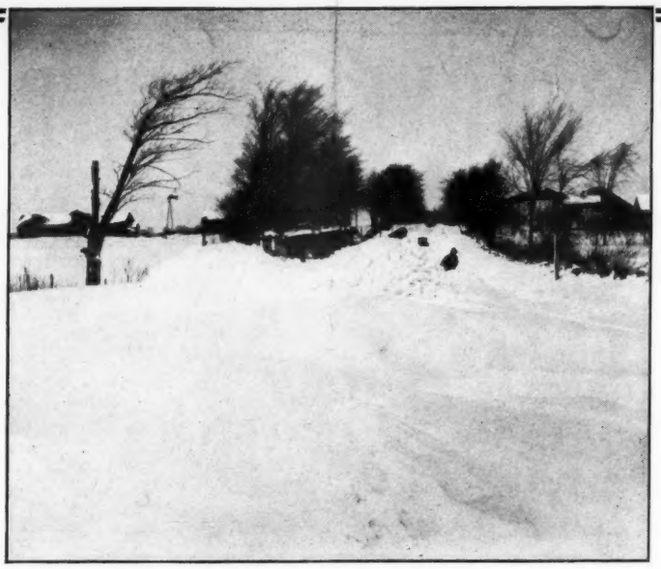

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107. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost and time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

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127. A new series of bulletins on road building and maintenance equipment have just been issued by Galion Iron Works & Mfg. Co., Galion, Ohio. These illustrate and give full information regarding their new variable weight Tandem Roller, Leaning Wheel Grader, Diesel Powered Motor Grader, Portable Roller and Chief Roller with "Roll-A-Plane" attachment.

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Shovels, Cranes and Excavators

145. The Austin Badger, a new, fully convertible ½ yard crawler shovel, made by The Austin-Western Road Machinery Co., No. A-5 Aurora, Ill., is fully described and illustrated in their Bulletin No. AD-1683.

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147. The Jaeger *Adjustable* Spreader for smoothly spreading stone, macadam and bituminous—1" to 7" thickness, 8 to 11 ft. width is described and illustrated in a new catalog now ready for distribution. Issued by Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

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152. The Columbia Alkali Corporation, Barberton, Ohio, will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing The Columbia Alkali Corporation, Barberton, Ohio.

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186. The new A-C *controlled ignition* oil tractor, the first tractor to combine gasoline engine simplicity and smoothness with fuel oil economy, is described in an illustrated bulletin recently issued by Tractor Division, Allis Chalmers Mfg. Co., Milwaukee, Wis.

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211. A complete booklet on dust control titled, "Dust Control and Road Stabilization," describes the use of Columbia Calcium Chloride for dust control purposes and stabilization of roads. Sent on request by The Columbia Alkali Corp., Barberton, Ohio.

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Activation and Aeration

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382. Roots-Connersville positive displacement blowers for moving air under moderate pressure or vacuum in volumes up to 700 cu. ft. per minute are described in Bulletin 21-B 17 recently issued by the Roots-Connersville Blower Corp., Connersville, Indiana. Blowers for larger volumes and higher pressures are covered under other bulletins which are available.

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386. This sixteen-page booklet is a reprint of a magazine article by a consulting engineer. It describes in detail the installation of a 42" water line; contains specific information regarding pipe joints, field organization, laying pipe, tests, back-filling, etc. Sent free by S. R. Dresser Manufacturing Company, Bradford, Pa.

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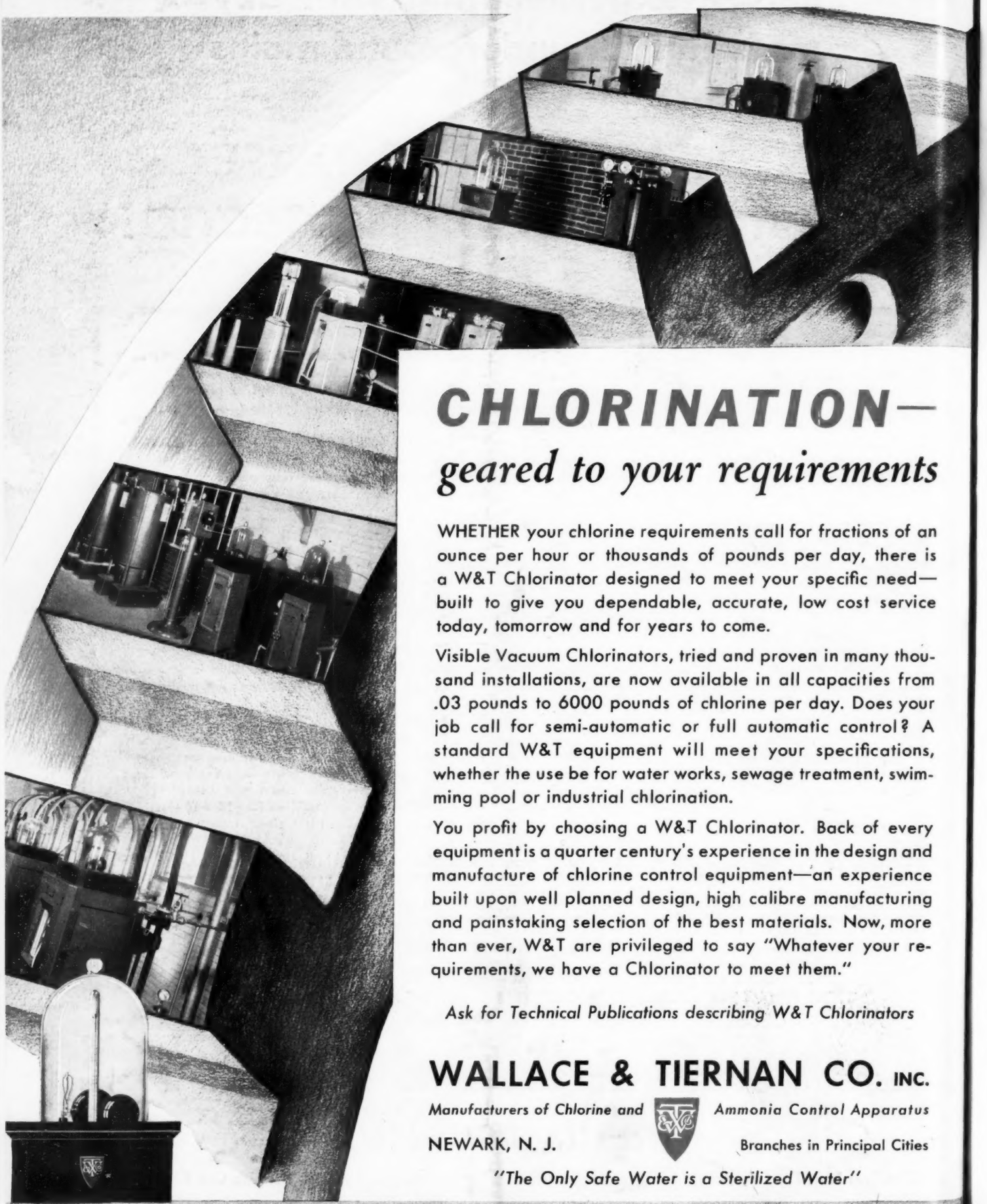

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